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IN THE UNITED STATES DISTRICT COURT FOR THE
NORTHERN DISTRICT OF OKLAHOMA

W. A. DREW EDMONDSON, in his capacity as ATTORNEY GENERAL OF THE STATE OF OKLAHOMA and OKLAHOMA SECRETARY OF THE ENVIRONMENT C. MILES TOLBERT, in his capacity as the TRUSTEE FOR NATURAL RESOURCES FOR THE STATE OF OKLAHOMA,	)
Plaintiff,	)
vs.	)4:05-CV-00329-TCK-SAJ
TYSON FOODS, INC., et al,	)
Defendants.	)

- -

VOLUME I OF THE VIDEOTAPED
DEPOSITION OF GLENN JOHNSON, PhD, produced as a witness on behalf of the Plaintiff in the above styled and numbered cause, taken on the 24th day of February, 2009, in the City of Tulsa, County of Tulsa, State of Oklahoma, before me, Lisa A. Steinmeyer, a Certified Shorthand Reporter, duly certified under and by virtue of the laws of the State of Oklahoma.

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A P P E A R A N C E S

FOR THE PLAINTIFFS:	Mr. David Page Attorney at Law 502 West 6th Street Tulsa, OK 74119
FOR TYSON FOODS:	Mr. Robert George Attorney at Law 2210 West Oaklawn Drive Springdale, AR 72762
FOR CARGILL:	Mr. Kerry Lewis Attorney at Law 100 West 5th Street Suite 400 Tulsa, OK 74103 -and- Ms. Melissa Collins Attorney at Law 1700 Lincoln Street Suite 3200 Denver, CO 80203
FOR SIMMONS FOODS:	Mr. John Elrod Attorney at Law 211 East Dickson Street Fayetteville, AR 72701

Exhibit F

FOR PETERSON FARMS: Mr. Scott McDaniel
Attorney at Law
320 South Boston
Suite 700
Tulsa, OK 74103

FOR GEORGE'S: Mr. James Graves
Attorney at Law
221 North College
Fayetteville, AR 72701

ALSO PRESENT: Dr. Roger Olsen

I N D E X

(Whereupon, the deposition began at 9:00 a.m.)

VIDEOGRAPHER: We are now on the Record for the deposition of Dr. Glenn Johnson. Today is February 24th, 2009. The time is 9:00 a.m. Would counsel please identify themselves for the Record? 09:00AM

MR. PAGE: David Page for the State of Oklahoma, and with me here today is Dr. Olsen.

MR. GEORGE: Robert George for the Tyson defendants. 09:00AM

MR. GRAVES: James Graves for George's Inc. and George's Farms, Inc.

MR. LEWIS: Kerry Lewis for the Cargill defendants.

MS. COLLINS: Melissa Collins for the Cargill defendants. 09:00AM

VIDEOGRAPHER: Thank you. The witness may be sworn in.

GLENN JOHNSON, PhD
having first been duly sworn to testify the truth, the whole truth and nothing but the truth, testified as follows:

DIRECT EXAMINATION

BY MR. PAGE:

Q Good morning, Dr. Johnson. 09:00AM

A Good morning.

Q My name is David Page, and I represent the State of Oklahoma. Would you begin by stating your full name and address for the Record, please?

A Glenn Wilbur Johnson, 9143 South Peruvian Circle, Sandy, Utah. 09:00AM

Q Dr. Johnson, have you ever given testimony under oath before?

A Yes.

Q Could you tell me when the most recent time was that you've given testimony? 09:01AM

A I believe that would have been June or July of last year.

Q And was that involved in a lawsuit?

A Yes, it was. 09:01AM

Q Can you briefly describe the lawsuit for us, please?

A That was -- it was in Seattle, Washington. I was working for the Port of Seattle, and they had been -- they and other parties -- I believe they were a defendant and being sued by the City of Seattle. 09:01AM

Q Okay, and what was your role in that case?

A I was looking at the PCB data at a former asphalt manufacturing facility on the Duwamish Waterway in Seattle, Washington. 09:02AM

Q Okay, and were you offering an expert opinion in that case?

A Yes, it was.

Q And what was the nature of the expert opinion, if you could summarize it for us, please? 09:02AM

A The primary source of PCBs at the site was Aroclor 1260, that it was consistent with transformers, and that the source of those PCBs were from City of Seattle transformers. 09:02AM

Q Okay, and so your -- is it fair to say your role in that case was source identification of certain PCB contaminants?

A Yes.

Q And where was those PCB contaminants found? 09:02AM

A They were found in soils of the former asphalt manufacturing facility and also in the sediments just offshore.

Q And what methods did you employ for source identification? 09:02AM

A Primarily looking at reported Aroclors and their concentrations at the site.

Q Okay. Did you do any multivariate analysis?

A No, I did not.

Q Okay, and have you given testimony in court in that case? 09:03AM

A No.

Q Is it scheduled for trial?

A No. It settled.

Q Settled, okay, and were you representing the plaintiff or the defendant? Were you representing the party making the claim for remediation of the 09:03AM

contamination or the party that was the alleged contaminator?
A I believe we were a defendant -- I believe the Port of Seattle was a defendant. I'm balking because I'm not entirely sure. It was -- I remember the attorney telling me at one point that depending on who got to the courthouse first, either side could have been considered a plaintiff. I don't recall exactly which way it ended up. 09:03AM
Q But your opinion was that the other party in the case or another party in the case was the cause of the contamination at issue?
A The City of Seattle. There were multiple parties in the case. 09:04AM
Q And you represented who?
A The Port of Seattle.
Q Right, and they were different entities in the case, the City and the Port? 09:04AM

A Yes, they were.
Q Okay. Did you do a comparison of the PCBs that were found in the media with the PCB that was from the source in order to identify the source of the contamination? 09:04AM
A The PCBs reported in the soil were overwhelmingly Aroclor 1260, as was the PCBs in the transformer oils that were given to the owners of the site in the early '70s, so in that respect, yes.
Q Okay. What about testimony prior to June or July of 2008? 09:04AM
A This might help if I could look at my CV. I have all my deposition testimony.
Q You know, we can do that.
A Okay. I can make a guess but I might end up skipping one as I go back in time in my head. 09:05AM
Q Sure. Why don't I give you a copy of your report which has your CV attached.
A Okay.
Q And then you can use that to remind yourself. 09:05AM
A Okay.
Q Dr. Johnson, I'm going to hand you what we've marked as Johnson Deposition Exhibit No. 1 and ask you to review and identify that, if you would, please, sir. 09:05AM

A This looks like my expert report in this matter.
Q Okay, and attached to it does it have a CV?
A Yes, it does.
Q Does that CV -- could you tell us where that CV is located in the report? 09:06AM
A It is the second appendix or attachment. I don't recall which I called it.
Q Is that designated with a letter B?
A Yes, Appendix B. 09:06AM
Q Okay. Now, let me just ask you preliminarily, does this Appendix B to your report include all of the cases in which you've given sworn testimony?
A Yes, I believe it does, but let me check.
Yes, I think this is -- these are them. 09:07AM
Q And when you were checking that, what portion of the report, Exhibit 1, were you looking at to determine what cases you've given sworn testimony?

A Page B-9 under expert witness testimony.
Q And it continues over to B-10? 09:07AM
A That's correct.
Q Dr. Johnson, just for the benefit of -- and you've testified before and, this is probably going to be both of our problems, but for the benefit of the court reporter, sometimes I pause before I 09:07AM

finish my question. If you could just give me a little bit of a time --
A Okay.
Q -- so we don't speak over each other, sir.
A Certainly. 09:07AM
Q Okay. Now, referring to Exhibit 1 and your CV, can you identify then the case you just testified concerning -- is that the first case listed under expert witness testimony on B-9?
A Yes, it is. 09:08AM
Q Okay. Do you want to go down the list and you can tell me about the different cases then since they include all of your testimony?
A Yes. The second bullet, actually I was never deposed. I wrote an expert report, and so that's 09:08AM actually -- there was no testimony there.
Q Okay. In that particular case, what were the issues you were involved with in drafting your expert report?
A This was a groundwater case near Los Angeles. 09:08AM The subject was chlorinated VOCs beneath two chemical solvent packaging facilities, and I wrote a rebuttal report about a year ago, March 2008, rebutting an expert that had used PCA applied to these -- to these contaminants. 09:09AM

Q Okay, and do you still have that report?
A Yes, I do.
Q Would you have any objection to producing it if I asked counsel for the same?
MR. GEORGE: We'll talk about it, and I'll 09:09AM note your request, and I'll get back to you.
MR. PAGE: Thank you.
Q Are you scheduled to give testimony in that case?
A No. 09:09AM
Q Is the case still pending?
A I believe it is.
Q Okay, but currently you haven't given testimony yet?
A I've not given testimony. 09:09AM
Q And in that case you reviewed a PCA -- what does PCA stand for?
A Principal components analysis.
Q Okay, and in that particular case, the one in southern California, you wrote a report evaluating 09:09AM the PCA analysis of another expert in the report?
A That is correct.
Q Okay. What about the next case you recall?
A This was an arbitration in Union City, Indiana. Again, the subject here was PCBs in 09:10AM

sediments of Little Mississinewa in flood plain in Union City, Indiana. The case settled. I was deposed in August of 2007.

Q And what were the subjects of your expert report in that case? I guess it was located in Little Mississinewa? 09:10AM
A The city is Union City, Indiana.
Q Okay.
A The river is the Little Mississinewa. It's one of those words I've read a million times but pronounce very infrequently, so I'm not even sure I've got the pronunciation correct. 09:10AM
Q Can you refer to it as the Union City case?
A Union City, yes, that would be fine.
Q Okay. In that case, what were the subjects of your report? 09:10AM
A Sources -- sources and alteration of polychlorinated biphenyls in sediments.
Q And did you employ PCA analysis in that report? 09:11AM
A I employed a technique called polytopic vector analysis, which uses PCA as an initial step.
Q Okay, and were you -- was your purpose to identify sources of the PCBs in the sediments in that case? 09:11AM

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A Yes.
Q And did you do so?
A Generally, yes. It was -- I qualify that because there was -- the PCB patterns in those river sediments were degraded and altered. So at the end of the day, there were -- definitive identification of sources was difficult because of -- because we were dealing with both source patterns and alteration patterns. 09:11AM
Q Okay, and how did you connect the sources in that case to the PCB contaminants or their degradation products? 09:11AM
A We identified the range of patterns in the sediments.
Q From the PCA analysis? 09:12AM
A Well, from the PVA analysis.
Q Okay.
A Determined what the -- determined what sources and/or processes that had been described in the literature were consistent with the patterns we were seeing, and based on that, made our conclusions about what sources were present and the degree to which we could confidently relate them to one versus the other. 09:12AM
Q When you refer to determine the sources that were present, do you mean you evaluated the different, I suppose, companies or entities that used PCBs in the area? 09:12AM

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A Yes, that was part of it.
Q And the type of waste PCBs they produced? 09:12AM
A The type of -- the type of PCB products that were used in their production.
Q May not have been waste; might have been just production?
A Yeah, probably spilled at some point. At that point we could argue whether it's waste or not. 09:13AM
Q Yeah.
A Both facilities used PCB in hydraulic equipment for die casting.

Q So you compared the PCBs or the degradation products you found in the sediments with the type of PCBs that were used by the different entities that were involved in the case? 09:13AM
A Yes, that's correct.
Q Okay. What about the next case, sir? We turn over to page B-10 then. 09:13AM
A Yes. The top of the page is San Diego Uniformed Port District versus TDY. TDY Industries ran a -- which I believe before that was Teledyne -- ran a facility near the airport in San Diego, 09:14AM

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California. They had drains and storm sewers that led to San Diego Bay, and there was PCB contamination in a little cove right across the street from that facility.
Q Can I interrupt you? 09:14AM
A Certainly.
Q When you say there was PCB contamination in the cove, are you saying there was PCB contamination in a cove that was in San Diego Bay?
A Yes. It's a little notch in the bay. 09:14AM
Q Okay. Near where the storm drain outfall was?
A Exactly.
Q Okay, and what was your role in that case, sir?
A I was representing General Dynamics, which is a company that had had a facility on the other side of the airport that had a storm drain that ran underneath TDY. So I was evaluating the data in the sediments, the data in the storm -- the sediments in the bay, the sediments in the storm drains and 09:14AM 09:15AM information related to sources on both facilities and other facilities to determine -- to arrive at an opinion on the sources of PCBs in the cove.
Q When you say you reviewed information related to sources, can you tell me what you mean by that, 09:15AM

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sir?
A Again, this was PCBs. Going from memory here, but I believe Teledyne Ryan had used PCBs in -- as hydraulic fluids, and that was consistent with a certain Aroclor that's often used in hydraulic 09:15AM called Aroclor 1248, and I reviewed the sediment data from catch basins and storm sewers underneath their facility, which was also predominantly 1248 and other -- and some of the other Aroclors, and I reviewed the PCB data from up the storm drain that had been collected. I'm sorry. Did I answer your question? 09:16AM
Q I think we're getting there.
A Okay.
Q Let me ask this question as a follow-up to your answer: Did you then compare what you understood that the entities that could have been the potential sources, their PCBs that you used, with the type of PCBs that were found in this cove to see if there was similarity; was that part of your source analysis? 09:16AM
A Yes, it was part.
Q Okay, and if I understood it correctly, you also looked at enter -- I guess transport locations along the way between where the PCBs could have been 09:17AM

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used to the cove to see if you also found those same PCBs along the way?
A To the extent that we had data like that, yes, I did.
Q That was part of your source determination analysis? 09:17AM
A Yes, it was.
Q And were you able to identify a source in that case?
A Yes. 09:17AM
Q Okay, and did you employ any multivariate analysis in that case?
A No, I did not.
Q Did any of the experts in that case?
A No, not to my knowledge. 09:17AM
Q Okay, and the next case, sir, if you could identify that on your Exhibit 1 and tell us about that.
A This was a case in --
Q Oh, may I back up? 09:17AM
A Yes.
Q I don't know if I asked you.
A Yes.
Q Did you give testimony in the case we were just talking about in San Diego Bay cove? 09:17AM

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A Yes, deposition testimony.
Q Okay, and did you testify in trial at that case?
A No. It settled.
Q Okay. Let me ask a question in case I forget. 09:18AM
In any of the cases in which you've been involved, lawsuits, did you ever give testimony in court?
A Yes.
Q Were you certified as an expert witness in those cases? 09:18AM
A Yes, I was.
Q Would you identify as we go along here which cases?
A It was the one we were about to get to.
Q Okay. Is that the only instance in which 09:18AM
you've been identified and certified as an expert witness in court?
A Yes.
Q Thank you, sir. Would you go to the next one?
A The next one in Grenada, Mississippi. The 09:18AM
topic -- the chemicals of concern were dioxins, and I was evaluating dioxin data from a wood treatment facility in comparison to soils in residential properties nearby.
Q Okay, and were you trying to do a source 09:18AM

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identification analysis?
A Yes.
Q Okay, and tell us, who did you rep -- who did you work for in that case?
A I worked for a law firm named Lundy & Davis. 09:19AM
Q Okay, and were they the company representing the alleged polluter, representing the alleged polluter, or the company that was recovering -- trying to seek recovery?
A They were the plaintiffs' attorney. 09:19AM

Q Lundy Davis?
A Lundy & Davis.
Q In Mississippi?
A I believe their firm is in Louisiana, but the case was in Mississippi. 09:19AM
Q Are they in Lake Charles, Louisiana?
A Yes, they are, that's correct.
Q Who was the lawyer that you primarily worked with at Lundy Davis?
A A gentleman named James Cain. 09:19AM
Q Okay, and did you identify a source of the dioxin contamination in that case?
A Yes.
Q Okay, and what investigative techniques did you use for source identification? 09:20AM

A Primarily visual inspection of dioxin congener patterns.
Q Could you explain that for the court, please?
A Well, dioxins -- when I use the term dioxins, I'm actually being a little bit imprecise. There's 09:20AM a group of chemicals called dioxins and another group of chemicals called -- well, polychlorinated dibenzo-p-dioxins is the full name, and then there's another groups of chemicals polychlorinated dibenzofurans. Furans technically are not dioxins, 09:20AM but both furans and dioxins were often run as part of the same analysis. So when I say dioxins, I'm basically talking about polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans.
Q Okay, and that's what you were investigating 09:20AM in this particular case?
A That's correct.
Q Okay. So you were going to tell me the visual inspection method. Would you explain that to me, please? 09:21AM
A Okay. So that was a preface.
Q Thank you.
A There are commonly collected, analyzed for these dioxins analysis seven dioxins and ten furans, and the relative portions of those dioxin and furan 09:21AM

congeners can be related back to sources. So I was looking at the patterns of those seventeen chemicals by direct inspection of bar graphs in comparison to source materials to determine what source the -- or sources the soils in the yards of the plaintiffs 09:21AM were consistent with or were not consistent with.
Q When you said you compared bar graphs of the source with the contaminated media, did I understand you correctly?
A Uh-huh. 09:22AM
Q What produced those bar graphs; was it the result of a chemical analysis that produced bar graphs for you to compare?
A That's -- the data that's plotted on a bar graph is a result of chemical analysis. What 09:22AM produced the actual bar graph was software.
Q What produced the data I guess is a more precise question? Thank you.
A It was a chemical lab in British Columbia.
Q And what was the analytical method? 09:22AM
A I don't recall the EPA number but it was -- it

was -- it was a standard method that's used for determining chemical composition of 2378 -- that's another buzzword jargon -- 2378 substituted dioxins and furans. 09:22AM

Q Roughly is it fair to say you compared the chemical composition of the contaminant at the source with the chemical composition of the contaminant in the contaminated media in order to determine whether the source and the contaminated 09:23AM media were related?

A Yes.

Q Next case, sir, would you go on to that? Oh, let me just ask real quickly, did you employ any multivariate analysis in that case? 09:23AM

A I did not in my initial report. The -- my counterpart in that case did present principal components analysis of data.

Q What do you mean by your counterpart?

A There was a consultant for the other side 09:23AM wrote an expert report that employed PCA.

Q Okay. Did you prepare any kind of rebuttal for that expert report?

A Yes, I did. Well, no, no, I didn't. The cases -- I don't want to venture into legal 09:23AM terminology, but the various plaintiffs, instead of being tried all at one time, were being tried one at a time. So I wrote a subsequent report about a subsequent plaintiff, but in so doing, I addressed the assertions of the -- that the expert on the 09:24AM other side had made using PCA. So technically it was not a rebuttal report.

Q Okay, and do you still have a copy of that report?

A Yes, I do. 09:24AM

Q Would you have any objection, subject to me talking to Mr. George, about producing that report?

A Subject to you talking to Mr. George, no.

Q Okay. Now, we can go to the next one, sir.

A Okay. This is in Kellum, et al, versus 09:24AM Kuhlman Corporation, and this is in Crystal Springs, Mississippi. My client was David Nutt & Associates, and this was looking at PCBs in soil and stream sediments and blood and other media, tree bark.

Q Okay, and it says here that you were 09:25AM identifying sources of these PCBs in these different media?

A That's correct.

Q And did you identify sources in this case?

A Yes. 09:25AM

Q What methods did you employ to identify sources of PCBs in the media involved in that case?

A Again, primarily comparison of raw sample bar graphs of PCB congeners to known source material or suspected source material. 09:25AM

Q So it was the same method that you employed in the Mississippi case we just discussed?

A Yes, different set of chemicals but similar approach.

Q Did you also evaluate samples, for example, in 09:26AM different environmental components considered like

the downstream from the source of the original contamination?
A Yes. We had data on site and in a stream -- downstream from the site and soils from residential properties. 09:26AM
Q And did you find that environmental component analysis to be probative in your source identification, that is, helpful in identifying the source? 09:26AM
A It was part of it so, yes.
Q Any other cases where you've given sworn testimony, sir?
A I don't believe so.
Q Okay. In that last case we just discussed, did you employ any multivariate analysis? 09:26AM
A I'm trying to recall. I might have looked -- I might have used multivariate analysis as an initial exploratory data analysis tool, but I'm pretty sure that my report was based on examination 09:27AM

of raw data by bar graphs.
Q Have you heard of something called the weight of evidence approach?
A Yes.
Q And what do you understand that phrase to mean? 09:27AM
A My understanding is that you take -- you take into account multiple lines of evidence into -- into coming to a conclusion.
Q Okay. Did you employ a multi -- excuse me, a weight of evidence approach when you worked on any of the cases you testified to? 09:27AM
A I don't know if I used that term, but I believe that, yeah, I would take into account the information that I had at hand. 09:28AM
Q So there would be multiple lines of evidence to support a conclusion that a source was or wasn't responsible for contamination?
A Yes, I believe so.
Q Is it your experience that that's a common approach in identifying sources of contamination in the environmental field? 09:28AM
A I think so.
Q Okay. Now, I think I was asking, and I don't recall if I gave you an opportunity to answer or 09:28AM

not, whether or not you provided any other testimony in any other matters that you're aware of to date.
A Oh, I think you did and, no, beyond what we just went over, no.
Q So in these other cases that fall on page B-10 -- 09:28AM
A I'm sorry. I just --
Q Quite all right. Those other cases that you've listed on B-10, those are cases where you worked in litigation but you never gave testimony? 09:29AM
A That is correct.
Q In any of those cases were you identifying or seeking to identify the source of contamination?
A Yes.
Q Which cases? If you would just kind of list the ones that you are identifying source and the contaminants you were looking into. We can just go 09:29AM

down the list, if you don't mind, on Exhibit 1.
A Okay. On B-10 the San Diego Unified Port District, we were looking at PCBs. 09:29AM
Q Did you employ PCA in that analysis?
A No, I did not.
Q Next one?
A Next one I believe I have used PCA-related techniques, not PCA specifically. 09:30AM

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Q How would you characterize the next entry? Can you give us a shorthand term? It just says a U.S. river estuary.
A There's sources of -- I'm not exactly sure what you're asking, but we were looking at sources of dioxin in sediments of a river. 09:30AM
Q And did you say you did or did not employ PCA in that case?
A I believe we did.
Q You did, okay. Did you prepare a report? 09:30AM
A No.
Q Did you prepare any PCA findings?
MR. GEORGE: Object to form.
A I probably discussed them with my client. I'm hesitant to answer too many questions about consulting expert projects where I was under confidentiality. So far I don't think we've crossed into questions that I'm unable to speak of, but I feel we're getting close. 09:30AM
Q What about the next item on the list? Looks like the Pacific Northwest river? 09:31AM
A Oh, this was on -- yeah. This was dioxins again. I'm sorry, what was the question with regard to this entry?
Q You were looking for the source of dioxin 09:31AM

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contamination?
A Well, with all of these, I think a better way to characterize it is we are evaluating the data and finding out the degree to which it supports our ability to infer sources.
Q Okay.
A To the degree that there is alteration involved and that -- and that sort of -- those sort of processes confound our ability to identify sources, I would say at the beginning, yes, that's the goal. At the end, no, that's not always the result. 09:32AM
Q Okay. In which of the cases we've discussed so far were you not able to identify sources?
A So we go back to -- 09:32AM
Q Yes.
A Okay. Back to the Washington, Seattle, City of Seattle versus Malarkey, where I was representing the Port of Seattle, that was pretty straightforward. The sources -- 09:32AM
Q So the answer is yes?
A The answer is yes.
Q Okay. What about the second one?
A Okay. I'm sorry. I was going to elaborate but if that's all you're interested in -- 09:32AM

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Q If that's okay.
A Okay.

Q I think you gave me a pretty good explanation of what you did?
A Okay.
Q And if it's important, then Mr. George or someone else here can ask you more questions about that, but I'm really just trying to determine in which of these cases we talked about, yes or no, did you identify or were you able to identify in your opinion a source for the contamination that was involved. 09:33AM
A Okay. The next bullet, which was Angeles versus McKesson, the objective was to determine sources. My opinion was that the data did not support getting to those conclusions. 09:33AM
Q Okay. Were there other experts in the case that identified sources?
A There were other experts that thought they did. 09:33AM
Q Okay. Next item?
A Next item is in Union City, Indiana, and this was the project we talked about earlier where there were two manufacturing facilities that used -- that used hydraulic fluids containing PCBs. 09:33AM

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Q And you were able to identify a source in that case?
A There were a lot of ambiguities because they used similar type of Aroclors, and once they got into the environment, they were degraded. So ultimately it was -- ultimately it was very difficult with that dataset because of alteration and because of similar sources used by both facilities to confidently apportion the relative sources there. 09:34AM
Q Okay, but were you able to identify the sources of the PCBs in that case? I thought I heard you just maybe say you weren't able to apportion it but you were able to identify the sources.
A Well, let me answer this way: We know that the original sources of PCBs were Aroclor 1248 and Aroclor 1242. Because of the degradation of those two Aroclors -- one of the parties used predominantly 1248; the other party used both. So even if there was no degradation, it would have been difficult to make -- to determine exactly who was responsible for how much, but then beyond that, there were alteration mechanisms within the sediments that could make an Aroclor 1242 look like an Aroclor 1248. 09:34AM 09:35AM

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Q So in that case -- I'm sorry. So in that case were you able to attribute the contamination you were focused on to a source or sources?
A No.
Q Thank you.
A The alteration processes made it difficult to do that.
Q Okay. The next case, which I think is the San Diego case, were you able to identify a source of the contaminants you were looking at in that case? 09:35AM
A Yes, but it was based more on concentration gradients than anything relating to patterns and Aroclors.

Q Okay, and what about the next case, which is in Mississippi? 09:35AM
A Yes.
Q That was what we called the dioxins from the wood treatment facility?
A Yes, that's correct.
Q And what about the Crystal Springs case? 09:35AM
A Yes.
Q Yes, okay. Okay, and then the first case there in the litigation support under other litigation arbitration support, also I guess a San Diego case. Were you able to identify sources in 09:36AM

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that case?
A That case settled before I finished an expert report and really before I finished my analysis. So I would -- I could not answer yes or no to that particular project. 09:36AM
Q Okay. What about the next case, sir?
A We could identify source categories. I use that term to differentiate from source. We know there are certain dioxin furan patterns that are related to types of output, but our ability to -- to 09:36AM link a congener pattern to a specific company or facility, we did not get there.
Q Okay, and the next one I think we were just talking about was Pacific Northwest U.S. river. That case, I think you mentioned, was dioxins? 09:37AM
A That was dioxins.
Q Were you able to identify the source in that case?
A That's similar to the San Diego project above, where that project we took a preliminary look at the 09:37AM data and never got to the point of writing a report. So I'm not sure if we would have gotten to the point of confidently identifying sources or not.
Q Okay, and the next -- the fourth bullet down under other litigation, was this also PCB work? 09:37AM

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A Yes, it was.
Q And was it to look for potential sources of PCBs that were found in the environment?
A Yes.
Q Okay, and were you able to identify a source 09:37AM in this particular case?
A In certain spots of the study area, yes. In other places there were ambiguities that made it difficult.
Q In this case you mentioned PCB fingerprinting. 09:38AM
What do you mean by PCB fingerprinting?
A Well, fingerprinting in my mind is more analogy than it is a methodology.
Q Is that when you compare the bar graph you were mentioning earlier? 09:38AM
A That can be it, yes.
Q Do you have any other methods that you would refer to as fingerprinting?
A Well, whether that bar graph is the result of a multivariate analysis or just comparison of the 09:38AM raw sample, I think that is a big part of what I considered fingerprinting the way that I do it.
Q So you consider fingerprinting would employ multivariate analysis?

A It can. 09:38AM

Q Okay, and I think in that case we were just referring to mentioning New York, you said some -- in some instances you wouldn't be able to identify the source and some instances you were not; correct?
A That's correct. 09:39AM
Q Okay. The next case, again you mention PCB fingerprinting. Did you employ PCA, by the way, in the last case, that one in New York?
A I don't recall. It was a small number of samples. So probably would not have been necessary, 09:39AM
but I don't recall if I would have ran an analysis like that or not.
Q Okay. In the case that you mentioned below that references a 1999 matter you worked on. Did you employ PCA in that particular case? 09:39AM
A Well, that's almost ten years ago. Yes, I did, not PCA, but a receptor modeling technique that uses PCA as a mathematical -- part of a mathematical bases.
Q Has a multivariate analysis? 09:39AM
A Exactly, a multivariate analysis.
Q Okay, and in that case were you able to identify sources of contamination?
A I don't recall. I do know that we had dechlorination, so we had alteration. I don't 09:40AM

recall if the alteration was to the extent that made it difficult to identify sources or not.
Q Okay, and the next case, I think it's referred to PAHs in Tacoma, Washington?
A Yes. 09:40AM
Q Did you -- were you doing source identification in that case also?
A Yes, I was.
Q And did you employ PCA or some type of a multivariate analysis? 09:40AM
A Yes, I did.
Q And were you able to identify a source in that case?
A Yes, but there was -- there was alteration of the PAH patterns, so we had to take into account 09:40AM
both.
Q You were able to identify sources even with alteration of the patterns of the PAHs?
A I guess the best way to characterize, we were able to identify sources with some statement about 09:41AM
certain patterns that -- certain patterns in certain samples that we were not completely confident in because of the degree of alteration.
Q Are you talking about the degradation of the product, the PAH product; is that what you mean by 09:41AM

alteration?
A That's exactly what I mean, yes.
Q In all these cases with the chemicals that you were investigating, were you primarily concerned with degradation products as being the alterations? 09:41AM
A Yeah, I think that would be fair.
Q Okay. I think I'm on the top of Page B-11 now, sir.
A Okay.

Q Again, this looks like a Texas matter about 1999. What were the contaminants you were focused on in that case? 09:42AM
A Pesticides.
Q Okay, and it says you did employ a multivariate statistical model. Do you recall which one in that case? 09:42AM
A I believe I used PCA.
Q Okay, and were you able to identify sources of the pesticide contamination in the soils in that case? 09:42AM
A No.
Q Why not?
A The -- again, this is one of those projects I'm going back ten years, but my recollection is that we were dealing with pesticide data from some 09:42AM

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kind of -- it was a standard SW-846 method, so an EPA standard method. We had issues with detection limits. There are just too many questions about data quality. This was a very short project. Once I realized that there wasn't a whole lot I could do 09:43AM with this dataset, I advised the client of such, and it was over pretty quickly.
Q Okay. What about the next item? I think it was Greenville, South Carolina. What were the contaminants of concern in that case? 09:43AM
A Contaminant of concern was chromium.
Q Okay, and did you employ a PCA analysis in that case?
A Multivariate analysis.
Q Okay, and were you able to identify the source of the chromium contamination in the groundwater in that case? 09:43AM
A My recollection is that we ended up with like eight to ten, again, I use the term fingerprint, although we're not talking about ridges on thumbs. We identified ten fingerprints. Two of the ten were related -- I believe had -- were related to chromium. 09:43AM
Q Okay, and does that fingerprint, as we're using in this context, include a PCA analysis? 09:44AM

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A It was a multivariate analysis that used PCA as an intermediate step.
Q Okay. So you were able to identify the sources of the contamination in the groundwater in that case? 09:44AM
A We found two patterns that were -- their locations were consistent with where -- again, I'm going from memory ten years ago, but were consistent with the locations of known chromium releases, so, yes. 09:44AM
Q Okay. Then the next one, looks like it's -- we're getting back here -- '92 to '94 time period.
A Yeah.
Q What were the contaminants concerned in that case? 09:44AM
A Dioxins.
Q Okay, and you say chemical fingerprints. Did that involve use of a multivariate analysis for those chemical fingerprint analyses?
A Yes, it did. 09:45AM

Q And were you able to identify the source of the dioxin contamination in that case?
A Again, similar to the other dioxin on the earlier page, we could identify what I'll call source categories, but when it came to the point of 09:45AM

pinning that to a specific property or a specific company, no.
Q Okay. You were able to identify the industrial processes that were related to those fingerprints; correct? 09:45AM
A At least some of the cases, yes. One of the congener patterns, I would say no.
Q Okay, and the last item there before we get to environmental site assessments, what were the contaminants of concern in that case, sir? 09:45AM
A This is 20 years ago. This is -- that was fuel oil constituents I believe in groundwater.
Q Okay, and did you employ a multivariate analysis in that case?
A No. 09:46AM
Q Okay. Were you able to identify the source of the contamination?
A I don't recall.
Q In the rest of your resumT can you tell us about any other investigations you employed, even if 09:46AM they're not related to litigation, where you did an evaluation to identify the source of some contamination?
MR. GEORGE: David, you're referring to the descriptions on B-11 and B-12? 09:46AM

MR. PAGE: I am, but if there's anything else in his CV that would identify the source identification work he did --
A Well, if you like, I'll go through -- just read through these. 09:47AM
Q If you would just take a look --
A There are definitely some publications before this that deal with those issues.
Q Okay, but where you've done some work where you actually were evaluating whether you could 09:47AM identify a source or not. If you could just look through those and just identify on the Record once you've had a chance to look through, if any of them involved source identification.
A Once we get below the other litigation 09:47AM arbitration and we get to the section on environmental site assessment/hydrogeologic investigation, these project descriptions go back to my days as a consultant before going back to get my PhD with -- so it would have been with one of two 09:47AM companies, either McLaren/Hart or Roux Associates. So I'll go through each of them for you, but in general this was is what I would call commodity consulting type of things where I was installing wells at a gas station or doing tank yanks, tank -- 09:47AM

underground storage tank investigations.
Q I think I'll take --
A But I'll be glad to go through that.
Q I appreciate that. We don't need to do that.
A Okay.

Q I think your description is sufficient. You mentioned that you said in your CV, though, there's some other source identification work that you'd like to -- or I'd like you to point out for me, if you would, on your CV. 09:48AM
A Okay. I'm going to page B-2.
Q Yes, sir.
A For publications/presentations.
Q Yes, sir.
A The first paper there, Johnson, Hansen, et al, that wasn't a field study where we were identifying sources, but it's a paper that evolved from these types of studies, in that on a couple of occasions in my career I found PCB patterns that were supposedly from the same source, Aroclor 1254, but had very different congener patterns. It was kind of a historical story as to why that happened. It was -- it had never appeared in the literature so -- 09:48AM
Q Okay.
A -- as we started to piece these things, the four or five authors or however many are on there, put out this paper. So it's relevant to source identification, but it's not a field study. 09:49AM

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Q Anything else?
A The next one -- the next one, PCBs in tree bark in Anniston, Alabama with Mark Hermanson, I would say we were looking at sources based on congener patterns there. 09:49AM
Q Were you able to identify sources in that particular study?
A In Anniston, Alabama, there was a single very conspicuous source of PCBs, which was the Monsanto facility that actually produced them. So we looked at the data, but we saw nothing new that suggested alternative sources. So we were evaluating sources, but it was not an analogous situation where we were going in with -- thinking we're, you know, looking for four or five. Had we seen evidence of others, we would have identified them. 09:50AM
Q You were able to relate the PCBs you found in the tree bark with the PCB patterns that you found in Monsanto's products; correct?
A I'd hesitate to put it that cleanly. The main pattern that Mark identified was a PCB pattern that we found in high concentrations in soils near the 09:51AM

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former Monsanto facility, so there was very little doubt where it came from.
Q Okay.
A But Monsanto never published a source standard of this particular thing. 09:51AM
Q Thank you. Any other work you did on source identification that you listed here under publications?
A The Carpenter paper, we were looking at PCB patterns. I'd have to go back and look at the paper, but I believe it had probably more to do with metabolism and alteration than source identification. 09:51AM
Q Okay.
A The Magar paper, part one, that was -- that had elements of source identification in it, but it 09:51AM

was another example of where we had alteration in the field that confounded our ability to confidently identify the source patterns, but some of them you could. Some of them it was -- some samples it was much more difficult because of alteration.
Q Okay.
A The next Magar paper -- those are basically companion papers.
Q So similar? 09:52AM

A Yeah, let's just say similar. There are differences, but they're probably of no interest to the people in this room.
Q Okay.
A DeCaprio, again, PCB congener patterns in blood serum. There was an element of identifying source, but any time you're looking at PCBs in blood, the identification of the actual source pattern is confounded by metabolism within the -- in this case the human body. 09:52AM
Q Okay. Anything else?
A The Nash paper was identifying soil, minerals in soil in high altitude remote sensing data.
Q It wasn't involving contaminants?
A It wasn't involving contaminants. 09:53AM
Q Okay.
A But if you consider a rock -- different rock type sources, in the broadest sense of the word it was source identification.
Q Okay. 09:53AM
A The Collister, that's basically a petroleum geochemistry paper where we were looking at the patterns of alkanes and other components of crude oil, and we were trying to make inferences about the original source rocks. There was an element of that 09:53AM

study that we were trying to identify the original source rocks that contributed to the patterns we saw in oil, but there was -- in many samples there was a high degree of microbial alteration that confounded our ability to do that. 09:54AM
Q Okay. In some cases you were able to do the source identification and in some case you were not?
A That's my recollection, yeah.
Q Okay. I think the next one is a textbook and I am familiar with that. So let's go to the next page. 09:54AM
A The next one is a PCB study of -- definitely related to sources in the San Francisco Bay.
Q You used a multivariate analysis in this case?
A Yes, and this -- again, this is another example where in some samples we did confidently relate it back to the source pattern and in other samples it looked like there was degrees of alteration. 09:54AM
Q Okay.
A The next one, the Chiarenzelli article, yes, we were looking at air samples and PCB congener patterns and trying to relate that back to sources.
Q Did you identify sources in that case?
A In some cases -- it's been a while. I'd have 09:55AM

to go back and look, but I believe there are two

datasets Jeff and I were working on. Jeff Chiarenzelli the first author. I'd have to go back and look, but the title of it, Microbially Dechlorinated Congeners from River Sediment, tells me that if we were identifying sources, we probably had caveats in there because we knew it was being altered in the field. 09:55AM

Q Okay. Have you done any source of identification on chemicals other than PCBs and dioxins? 09:55AM

A Yes.

Q Chlorinated solvents I guess you also looked at; right?

A Yes, and also the chromium was groundwater -- chromium was one of the chemicals involved, but we were also -- also in that suite of analytes were other metals. 09:55AM

Q Metals. Any other contaminants you've evaluated for source evaluation? 09:56AM

A Oh, well, we discussed the PAH thing as well.

Q Okay. Anything else?

A So inorganics, dioxins, PCBs, PAHs. There may be. Those are the ones that pop to mind at present.

Q Okay. Let's take a break now. 09:56AM

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A Okay.

VIDEOGRAPHER: We're now off the Record. The time is 9:56 a.m.

(Following a short recess at 9:56 a.m., proceedings continued on the Record at 10:14 a.m.) 10:14AM

VIDEOGRAPHER: We are back on the Record. The time is 10:14 a.m.

Q Dr. Johnson, where are you employed?

A I'm employed -- I'm a research associate professor at the University of Utah, and I also do a lot of consulting through my own firm, which is called GeoChem Metrix, and it's under that entity that this work has been done. 10:14AM

Q Can you tell me what work you do as a research associate at the University of Utah? 10:15AM

A I teach within the department of civil and environmental engineering. I do research projects as they come in, and some of them are environmentally related, PCB related, and some of them are related to micropaleontology and biostratigraphy. 10:15AM

Q Can you tell me what classes you teach at the University of Utah?

A I teach a class called ecological systems in engineering, and that's the only class I teach right now. 10:15AM

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Q Have you taught other classes in the past for the University of Utah?

A At the University of Utah, no.

Q At other universities? 10:16AM

A I have taught as a TA at the University of Delaware. Taught a groundwater hydrology class at Wagner University one semester in the early '90s.

Q Can you provide for us a summary of the subject matter for the class you are currently teaching at the University of Utah that you called ecological systems in engineering? 10:16AM

A That is correct. That is -- right now it is a graduate level class. In the past it has been both -- I've been teaching it since 2000. In the past it has been dual listed graduate and upper level undergraduate. The course was created within the civil engineering department in the late '90s primarily because a lot of -- a lot of civil and environmental engineers end up getting this far into their curriculum having not had much biology-related types of course work since -- sometime since high school. So the first half of the class is basic undergraduate level biology and ecology. The second half of the class is how that type of subject matter 10:16AM 10:17AM 10:17AM

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ends up impacting engineers. So specifically in environmental engineers, issues such as risk assessment and for civil engineers, issues such as environmental impact statements.

Q Does this class cause you to teach any multivariate statistical analysis? 10:17AM

A We do do statistical homeworks. I can't recall right now if we end up doing any multivariate related ones. I've had students do their term paper, and they're allowed to pick the topic that's relevant to them. I've had students end up doing term papers that have a multivariate statistic aspect to it. 10:18AM

Q When was the last time you taught this course?

A It's fall of 2007. 10:18AM

Q Okay, and when is it scheduled to be taught again?

A Fall of 2009.

Q So about every two years you teach it?

A It was every year from 2000 to 2005. It has been every other year since then. Well, fall 2005, fall 2007, scheduled for fall 2009. The faculty would like to get it back to an every-year offering again after that. 10:18AM

Q If you were to apportion your time between 10:19AM

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your consulting company and your work at University of Utah, how would you apportion it percentage-wise?

A It changes from year to year. Over the past year it has probably been 80 percent consulting. In other years -- let's see. About the time the Olympics were in Salt Lake, I was almost no consulting, all university. The past two years my consulting load has been much higher than my university load. 10:19AM

Q Do you have any employees that work with you at Geo Metrix? 10:19AM

A No. My -- my wife handles billing and that sort of thing, but technical employees, I'm the only one.

Q Exhibit 1 is your report in this case; correct? 10:19AM

A That's correct.

Q Did you have any assistance in any of the analysis that's represented by Exhibit 1?

A I did all the analyses myself. 10:19AM

Q Okay, and did you do all the writing yourself also?

A Yes.

Q Okay. Does Exhibit 1 contain all of the opinions that you have been asked to provide in this case?
A Yes, I think it does.
Q And does it describe all the analyses you performed in order to reach those opinions?
A I think so, yes. 10:20AM
Q It would help me, Doctor, if you would give me an overview or I'll call it a summary or even an outline of your key opinions in the case.
A May I refer to my report?
Q Absolutely. I just want to -- if you were going to identify the key opinions or the most important opinions, principal opinions, if you could provide those summarily for me so that I could have an understanding about your report. 10:20AM
MR. GEORGE: Object to form. 10:21AM
A In Section 1, there's a Subsection 1.3, which lists my primary opinions, the big picture opinions, and there are six bullets there. I'd be glad to go through them one by one if you'd like.
Q Yeah. Would you just summarize them for me, please, sir? 10:21AM
A Okay. Back up one step. For the context, what I was asked to do by my client was to evaluate the degree to which principal components analyses run by Dr. Olsen did or did not support the conclusions that he -- that he expressed in his report. 10:21AM
Q So let me ask you, can I follow up on that particular comment, please?
A Certainly. 10:22AM
Q Were you asked to do anything else by the defendants in this case?
A That was my major charge. I -- at times I may have been asked to do other tasks that were related technically to that. For example, I was asked to review materials to help Mr. George in preparation for his deposition of Dr. Olsen, but so I would consider that a slightly different task but still part of the same technical umbrella. 10:22AM
Q But your focus, if I understand it correctly, was to evaluate the principal component analysis or PCA that Dr. Olsen employed -- 10:22AM
A That's correct.
Q -- in his opinion?
A I'm sorry. I was talking over you. 10:23AM
Q That's okay. And were there any other analysis or evaluations that you performed for the defendants that are not found in your report?
MR. GEORGE: Object to form.
A I looked at some maps of just -- of the -- just concentrations of certain chemicals in the watershed. 10:23AM
Q Did you prepare any written analysis?
A Didn't prepare any written analysis. I believe some of those maps were produced. 10:23AM
Q Were they -- what do you mean by maps of concentrations?
A Well, for example, obviously phosphorus is a

concern here. So I put together a map of phosphorus concentrations within the watershed so I could just see where the high concentration areas of phosphorus were located.

Q Was that produced as part of your considered materials?

A I believe there's a map in there that shows that, yes. 10:24AM

Q Okay, and did you -- did that analysis result in you forming any opinions?

A I'd say -- I'd characterize it supporting my opinion, but it wasn't -- I wouldn't say it was what formed my opinion. 10:24AM

Q It supported an opinion that you provided in your report?

A Yes.

Q Why did you not then include it in your report? 10:24AM

MR. GEORGE: Object to form.

A Well, can I give you an example?

Q Sure.

A In looking at the concentrations, there's a stream water sampling location downstream of Siloam Springs that identifies -- Dr. Olsen's report identifies as having high concentrations of phosphorus. I ran this map to see -- to see if concentrations at that sample station indeed were higher than others relative to that. 10:24AM 10:25AM

When I wrote my report, rather than present yet another map with that analysis, I cited the location in Olsen's report where he acknowledged that that sample had high phosphorus, and for the purposes of how I was writing my report, that was sufficient to make that point so I did not include the map in my report. 10:25AM

Q Part of your work I would call it was an evaluation, kind of like what I call a poultry house density analysis? 10:25AM

A Not my work. I adopted the poultry house density -- I used the poultry house density map provided in Dr. Olsen's produced materials as a base map for a number of the figures that I included in my report. 10:26AM

Q But part of your analysis was to review his poultry house density analysis or his spatial analysis, and you critiqued it; is that correct?

A That's correct. 10:26AM

Q Okay, and so was this map you're talking about with phosphorus concentrations, was it employed to do that type of spatial review?

A I don't recall if I plotted that data over the top of poultry house density base layer or not. 10:26AM

Q But was it part of an evaluation of Dr. Olsen's -- was this phosphorus gradient map you prepared, was that intended by you to be used to evaluate Dr. Olsen's spatial analysis?

MR. GEORGE: Object to form. 10:27AM

A My recollection is not specifically. I mean, if I had seen something drastically inconsistent with what I was -- with the part of my analysis that was plotting things over poultry house density, I

probably would have noted it. 10:27AM
Q Okay. Anything else that wasn't included in your report that you did some analysis for in this case?
A Yes. When I was first contacted by Tyson to potentially work on this project, it was actually 10:27AM

prior to the production of Dr. Olsen's report, I was sent his considered materials from the preliminary injunction, which included preliminary PCA runs, and I looked at those materials to see what those preliminary PCA runs were looking at. 10:28AM
Q Okay. Anything else?
A Not that I recall.
Q Okay. Now, I interrupted you. You were going to give me a summary of your key opinions. Would you proceed with that? 10:28AM
A Oh. Sorry.
Q I interrupted you. Please continue.
A That's okay. The first opinion is labeled the Fallacy of the Unique Poultry Waste Signature, and my opinion is that Dr. Olsen's PCA cannot 10:28AM differentiate between poultry and other sources in the Illinois River watershed.
His sampling included collection of -- for samples to characterize sources, they were predominantly skewed towards sources that he 10:29AM presumed from the outset to be related to poultry, and I'm speaking of edge of field samples, which was on the order of 60 to 80. In contrast, there were few samples designed to characterize sources other than poultry, for example, cattle, wastewater 10:29AM

treatment, and in looking at those samples, the PCA cannot -- using his criteria, the PCA cannot distinguish between those source categories.
Q And that's your opinion?
A Yes. 10:29AM
Q Okay. Anything else under this first opinion?
A Under that first opinion, the final sentence is citing Dr. Olsen's deposition testimony where he was asked if he had considered other sources such as spray irrigation, and there's a whole list there, 10:29AM and his response was no, that he had not.
Q And did Dr. Olsen to your recollection offer any reason why he didn't particularly sample those sources?
A Not that I recall. 10:30AM
Q You don't recall any reason for that?
A No, I don't.
Q If you take a sample from -- an ambient water sample from a stream, would you assume that sources that are releasing contaminants upgradient from that 10:30AM stream could be included in those ambient samples?
MR. GEORGE: Object to form.
A Could you restate that, please, I'm sorry, reask the question?
Q I'm going to ask the court reporter to read it

back for you.
A Okay.
(Whereupon, the court reporter read back the previous question.)

A Yes, they could. 10:30AM
Q Okay. Could you look at the second key opinion, please?
A Yes. I concluded that he made errors in assumptions of the basic PCA method. Do you want me to stop there? 10:31AM
Q Well, I would like you to explain --
A Okay.
Q -- in summary form what methodologies you claim he made error in.
A I list two in that bullet. He's assuming the unique source signature will be conserved in the environment. In other words, what drives the PCA patterns that you can identify from PCA-based method is -- at the end of the day is based on ratios and the relative proportion of the different variables, in this case chemical, analytes and bacteria, and the implicit assumption, when you are looking at those relative proportions, if you are going to say that's what -- if you're concluding that a pattern you see in the ambient environment is related to 10:31AM 10:32AM

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source and matches the pattern in a source, you're making the implicit assumption that those ratios or those relative proportions of analytes don't change in the environment. I think that assumption is false. 10:32AM
Q Okay. Anything else that you're critical of concerning the PCA methods?
A Yes. The assumptions --
Q This will be the big pictures.
MR. GEORGE: Hang on one second. I want to object, David, to the extent we're trying to limit the witness' testimony based upon having him summarize his report. I just want the Record to reflect that we're not withdrawing any of the opinions he's offered in his report simply because they're not mentioned in the summary. 10:32AM 10:32AM
MR. PAGE: That's not the purpose of my question, Mr. George. I'm trying to get an overview, understand the big picture.
Q So you've mentioned the one concern you have about conservation of the chemical in the environment; correct? 10:32AM
A Yes.
Q Now, were there any other critical methods that you have concern with? 10:33AM

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A Well, we are not really to method here. We are in the -- we're calling it errors of assumption. So the second major error of assumption that I identified was the equating a principal component to a source-related fingerprint. 10:33AM
Q Okay, and could you explain what your criticism is in that regard?
A A principal component is -- principal components analysis is a linear transformation of a dataset. You end up with a group of what are called principal components, which are basically axes in space, these lines in space that are at 90 degrees from each other that allow you to plot samples or look at samples in a reduced dimensional -- on a reduced dimensional diagram or within reduced 10:33AM 10:34AM

dimensional space. There is no reason to assume that a principal component equals anything with chemical or physical meaning, and in my experience, having done PCA-based applications for 20 years, I have seldom, if ever, seen a case where principal component composition was equivalent to a source or a fingerprint.

Q Okay. You would agree, though, that a principal component could be related to a source or a fingerprint? 10:34AM

A I wouldn't characterize it that way either.

Q Would you agree that a principal component could be associated with a source?

MR. GEORGE: Object to form.

A I'm not sure what you mean by associated with. 10:35AM

Q Well, let me ask you this: When you identified for us earlier today that you were able to identify a fingerprint or identify a source --

A Uh-huh.

Q -- using PCA or other multivariate analysis, what did you mean by that? 10:35AM

A I mean that we used the principal components' axes as a reference space to do a subsequent analysis that would allow us to find points in space that did represent fingerprint patterns. Again, we're using fingerprint in the sense of an analogy, but in every single instance that I've done such -- an analysis such as this, the location of that composition that I conclude is related to a source is not coincidence with the location of the principal component axis. It's at a different location within that reduced dimensional space. 10:36AM

Q Okay, but you'll agree that multivariate analysis is a means by which source identification can be done? 10:36AM

MR. GEORGE: Object to form.

A If it's done correctly.

Q Okay. Anything else under the second opinion?

A There might be more detail behind the report, but those are the big two that I brought out for the bullet. 10:36AM

Q Okay. Anything else, key opinions, key opinions?

A Well, there are four more.

Q Okay. Let's go to the third one then. 10:37AM

A Errors of PCA Implementation. Dr. Olsen made a number of errors in implementation of PCA. He ignored goodness-of-fit statistics that suggested he should retain more than two principal components. Would you like me to go through all three or would you like to ask me questions as I -- 10:37AM

Q Just I'll try to do this or something if I want to interrupt you.

A Okay. Data transformations that he used were not appropriate for this type of analysis. That was the second one. Third, rather -- 10:37AM

Q Could you be a little more particular in that particular issue of the data transformation was not appropriate?

A The transformations he used were first a log 10:37AM

transform, and then prior to his PCA, he ran a correlation matrix, which is mathematically identical to taking the autoscale transformation. Autoscale transformation is extremely useful. Log transform I don't think was the best choice for this, but the point that I made farther back in the report is not -- in my mind the one -- it's the transformation he didn't do that concerned me, and that was the lack of any sample normalization. 10:38AM

Q That's when you employ fractions? 10:38AM

A Well, fractions or proportions or normalizing to some key indicator species.

Q Okay. We're going to get to that later. When you said that the second transformation, is that known as the Z-transformation you just mentioned? 10:38AM

A If you do it outside of -- if you do it as a transformation of the data itself, it would be a Z-transformation. If you just take the correlation matrix of whatever matrix precedes that, then you're not technically doing a Z-transformation, but for all intents and purposes you are. 10:38AM

Q Okay, and what is it, your understanding, that Dr. Olsen employed in his PCA?

A My understanding is that he did a log transform of the data and then did -- and then 10:39AM

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clicked the option within SysStat to take the correlation matrix of the log transform data prior to running the PCA.

Q Okay. Anything else under this third bullet?

A Yes. Rather than using the PC scores calculated and reported by SysStat, he chose to calculate the PC scores himself, and in the process he did the calculations incorrectly. 10:39AM

Q Okay. He failed to log transform the results after he received them from the PCA analysis? 10:39AM

A Yes, I think that's correct.

Q Okay. Anything else?

A He did not evaluate goodness-of-fit on a variable-by-variable basis. So he is apparently unaware of several parameters that he considers diagnostic of his unique poultry waste signature, and I list them, bacteria, arsenic, copper and zinc, exhibited a poor fit to the model. 10:40AM

Q Could you explain that, sir?

A Yes. One of the key questions in PCA is how many principal components do you retain for an analysis. There are a number of ways in the literature to help you get to that determination, and in my book chapter I outline them, and also in my book chapter I advocate the use of evaluating 10:40AM 10:41AM

0065

goodness-of-fit on an analyte-by-analyte basis. In other words, you just don't look at the percent variance of the dataset as a whole. You want to look and see if you are accurately back calculating each and every variable to an acceptable degree. I think he should have done that, and I don't believe that he did. 10:41AM

Q Okay. Anything else under this fourth item, fourth key opinion?

A Only that I'm pointing the reader to Appendix A where there's more detail on all of these. 10:41AM

Q Could you go on to Opinion 5, sir?
A Yeah. Opinion 5 -- I'm sorry. I've got that as -- one, two, three four.
Q So we're on to four. Excuse me. 10:41AM
A Well, they're bullets, not numbers, so --
Q The fourth bullet then, sir.
A Data Quality Problems. There are problems with the quality of dataset, such that I'm doubtful that a correctly implemented PCA would have yielded 10:42AM
results that allowed differentiation of sources.
Q Were these data quality issues that were identified by Dr. Cowan or were these issues that you identified personally?
A I identified them. I think Dr. Cowan may have 10:42AM

0066

identified them independently.
Q Okay. Have you read Dr. Cowan's expert opinion?
A No, I've not.
Q Okay. The -- could you describe the data 10:42AM
quality problem in a little more particularity?
A Well, the two that I focused on, and I focused on these because they were listed by Dr. Olsen as being important in his poultry -- what he calls his
poultry -- chicken fingerprint, poultry signature. 10:42AM
It goes by a number of names.
The two that I focused on were bacteria and phosphorus. Bacteria was missing in a high proportion of his samples. Depending on the
bacteria variable, between 28 percent and 41 percent 10:43AM
of the data in his primary PCA run were missing. In addition, and this was what I found odd, they were missing in a great number of samples, but in other samples they were actually replicated two, three,
four times. 10:43AM
Q In bacteria?
A In bacteria, and I cite an example of one sample that the Excel subdatabase that I was working from had four values for one of the bacteria
variables. 10:43AM

0067

Q Anything else?
A Well, my issue with phosphorus is that there were multiple lab methods used, and I identified the issue of using data from different lab methods as
something you need to be very careful with in some 10:44AM
of the material that I've written.
Q Have you ever done that yourself?
A I'm sorry, done what?
Q Used data in an analysis that had different analytical methods for the same constituent. 10:44AM
A Yes, I have, but I preceded it by valuing the degree to which -- to which they were analogous, and most of the time I felt most comfortable by -- by --
I -- very often I will run an analysis when I run into that situation, and it happens a lot with PCB 10:44AM
data because two labs, even running the same EPA method number, may be using the columns that give you different co-illusions, so you even get slight
methodological differences between them. So, often you'll end up with PCB data from multiple methods. 10:45AM
Q Okay. Well, in this --
MR. GEORGE: Hang on. Let him finish your

answer.
A The question was have I done this?
Q Yeah, and you have done it with your PCB analysis? 10:45AM

0068

A I have done it, but the point I wanted to make before we got off of that is, to the extent I had done it, I evaluate the degree to which they are comparable, and I would say the majority of the time when I've done this, I ended up running that just to see the degree to which there was -- well, the shorthand we use is to see if there's a county line fault, you know, a drastic distance in the patterns that seem to be related more to the methodology than the -- than actually what's going on in the field, and so in most cases I end up trying to keep all one data analysis method in one analysis at a time. 10:45AM
Q Okay, and in this particular case, what constituents did you have this concern with? 10:46AM
A Phosphorus.
Q Okay. Did you compare the analytical methods in this that were employed in this particular case to see if they were comparable?
A I tabulated the data within PCA run SW3 based on the phosphorus method that was used. 10:46AM
Q Okay.
A Well -- and I did not do an analysis of my own to determine the degree to which there was bias, but in Dr. Olsen's report, he acknowledged that one of 10:46AM

0069

the methods that was included in all three of those phosphorus method had the capability of being bias high.
Q Okay. Did you compare -- my question, though, Doctor, was did you compare the analytical methods for phosphorus that were employed to see if they were comparable methodologies? 10:46AM
A No, I did not.
Q Anything else under Bullet 4, sir?
A We discussed multiple labs, multiple analytical methods, missing substitution strategies. 10:47AM
Q Can you give me a sentence or two explanation what you mean by that?
A Yeah. When there were data missing for certain analytes, when I ran -- when I reran these analyses, and specifically within SysStat, when I wrote these datasets in and run them, I would not get -- I would not get scores for the missing data. So I went back to try to find out what was going on with the missing data, and what I determined is that in order for me to get scores, I had to substitute in the average of the non-missing data into the cells where there was missing data. 10:47AM 10:48AM
Q And you did that manually so to speak?
A I did it in -- used software but, yes, I did it myself. 10:48AM

0070

Q You actually calculated the mean of the non-missing data and substituted that for the same constituent where there was a missing data point?
A Correct, and when I did that, I would match his scores or come very close. 10:48AM
Q And you accuse Dr. Olsen of doing the same

thing?
MR. GEORGE: Object to form.
Q Is that correct? 10:48AM
A If he did not do it exactly the way I did it. He did the equivalent of substituting the mean.
Q How so; how did he do the equivalent?
A I never figured this out, but in his report he said he doesn't get to the calculation of scores 10:48AM until after he's already run the PCA step. So it wasn't clear to me how he was going about calculating scores on the back end of the PCA. SysStat would not give you those scores. By trial and error, I found out that I could match his scores 10:49AM if I went back to the beginning of the analysis and substituted that mean in at the front end of the analysis, and when I did that, my scores closely matched his scores, his reported scores.
Q But they weren't the same? 10:49AM

0071

A They were -- there are a couple of samples that were not identical, but the general shape of the data cloud was very, very similar.
Q Anything else under this fourth bullet?
A I think sample representativeness problems, I 10:49AM have to look at the appendix, but I think that may be related to the issue of having presumed sources being highly skewed towards samples presumed to be poultry-related edge of field.
Q Anything else? 10:50AM
A The last sentence there is I'm pointing the reader to Appendix A for additional detail, and also I was aware that Chuck Cowan was doing a similar -- was addressing similar issues.
Q Okay. You reference in the last sentence 10:50AM there Dr. Cowan's report, do you not?
A Uh-huh, yes.
Q Did you just testify that you did not read his report?
A I did not read it, no. I was -- but I was -- 10:50AM as we were preparing our reports, there were a number of conference calls where experts' reports were discussed with counsel. So I have not read his report, but I was on a -- I was on a conference call where this aspect of his report was being addressed, 10:51AM

0072

and so I knew it was being addressed in his report.
Q Are there any other citations or references in A-3 where you make reference to a document that you have not read?
A I believe I was aware that Sam Myoda was 10:51AM addressing issues of -- with bacteria representativeness and duplicates and replicates and that sort of thing.
Q Did you read his report?
A No, I didn't. You asked are there other 10:51AM examples. That's another, Sam Myoda's report.
Q Did you talk to Dr. Myoda about what his report contained?
A Yes. I asked him if he was addressing that issue, and he said, yes, he was. 10:51AM
Q In a general fashion?
A Yes. I'm trying to recall if I was on a conference call with him or not, but I know I did

talk to him.
Q Anything else that's referenced here that you reference but you did not read? 10:51AM
A If you let me look at the references section --
Q Please do. I think it's Page A-32.
A That would be the references for the appendix. 10:52AM

So let's start with the references for the main report.
Q Okay. Good thinking. It's on Page 72 of your report?
A Correct. 10:52AM
Q Thank you. So you reference Charles Cowan both in the appendix references and the main references, his expert report, but you did not read that; correct?
A That's correct. I believe that's it, just those two. 10:52AM
Q Thank you. Okay. I think we're now on -- maybe can we move to Item No. 5 or Bullet No. 5 of your key opinions, and if you would summarize that for me, please, sir. 10:53AM
A Bullet 5, I'm talking about contradictions in his interpretation, and the point I'm making here is even if we ignore all of the issues raised in the previous bullets, just take the analysis and interpretation at face value, there are major contradictions. 10:53AM
Q Could you give me an example, sir?
A An example would be in Tahlequah, Oklahoma, it's a town that plots with -- on the -- on his poultry density map in a green area, which on that 10:54AM

map means zero poultry house density, but all the samples in that town ended up with Principal Component 1 scores above the threshold that he established for poultry impact.
Q Okay. Can you give me any other examples other than ones where you did, I guess, a comparison to poultry house density? 10:54AM
A Well, the wastewater treatment plants. There were three wastewater treatment plant effluent samples, and my understanding is these were actual samples of the effluent coming out of the pipe. So I don't recall what the poultry house density was in the subbasin that they were in, but given that they were basically effluent samples, it doesn't matter. It tells me that a source collected for the specific reason from an outfall pipe characteristic of something other than poultry ended up with a Principal Component 1 score that was higher than his poultry signature threshold of 1.3. 10:54AM 10:55AM
Q What doesn't matter? You just said it doesn't matter. I'm not sure I understood what you meant by that. 10:55AM
A The reason I say it doesn't matter is because if you're collecting a sample at an effluent pipe coming out of a wastewater treatment plant, to me 10:55AM

it's irrelevant what the poultry house density is in the land that surrounds it because that particular sample is -- it's difficult to argue that that could

be impacted by runoff from a field when it's collected out of a pipe. 10:56AM
Q What would be relevant?
A I'm sorry?
Q What would be relevant to -- if you're considering a wastewater treatment plant effluent in this analysis; would there be any things you would 10:56AM consider concerning the wastewater treatment plant?
MR. GEORGE: Object to form.
A I'm not sure I understand.
Q Let me ask this question: Do you know -- these wastewater treatment plants you did an 10:56AM evaluation of, do you know whether or not they have any industrial contributors to any of them?
A I don't know what the contributors are to the wastewater treatment plants.
Q Would it be relevant to you to know that a 10:56AM wastewater treatment plant had as a contributor a poultry processing facility?
MR. GEORGE: Object to form.
A What I would expect is if there were extenuating circumstances that could explain away a 10:57AM

0076

wastewater treatment plant sample with -- that had Dr. Olsen's poultry signature, that the onus would be upon him to find those extenuating circumstances and explain away how that could happen.
Q I'm going to have to move to strike as 10:57AM non-responsive. Now -- and that's a lawyer term saying that I want you to answer my question.
A Okay.
Q And my question is, would it be relevant for you to know whether or not a wastewater treatment 10:57AM plant facility had a poultry processing facility contributing its waste to that facility?
MR. GEORGE: David, are you representing to the witness that that is the case with respect to the samples? 10:57AM
MR. PAGE: Yes, I am. We'll get to that point.
MR. GEORGE: Okay. Object to form.
Q But mine was a hypothetical.
A Okay. I would -- if that's what you're 10:57AM representing, I would definitely evaluate it. I think it would be -- it would be relevant to analyze that information. Would it be okay if we took a break?
Q Yes, sir. 10:58AM

0077

VIDEOGRAPHER: We are now off the Record. The time is 10:58 a.m.
(Following a short recess at 10:58 a.m., proceedings continued on the Record at 11:06 a.m.) 11:06AM
VIDEOGRAPHER: We are back on the Record. The time is 11:06 a.m.
Q Dr. Johnson, before we took our break, I think we were talking about Bullet No. 5, and it relates to your key opinion on contradictions in Dr. Olsen's 11:07AM interpretation.
A Uh-huh.
Q I think we talked about an example, poultry house density, and also wastewater treatment plant

results. Do you have any other examples that could you provide us that don't relate to those categories? 11:07AM

A Yeah. The other one I pointed out was cow pasture edge of field samples.

Q Okay. Now, Item No. 6? 11:07AM

A Item No. 6 is Dr. Olsen failed to recognize the influence of total concentration and geochemical partitioning on the PCA. By assuming at the outset that it was a source-controlled system, I think he missed the two primary controls on surface water in 11:08AM

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this system, which is -- the degree to which -- well, first of all, total concentration and second, the degree with which how chemicals redistribute themselves in the environment according to their affinity for being bound to particulates or being in 11:08AM a dissolved phase.

Q This is your muddy, salty water?

A Yeah, it's the shorthand that I used within the report, but, yes.

Q Anything else; any other key opinions? 11:08AM

A I think these are the six that I pulled out because I thought they were the key six, so --

Q Fair enough, and, again, I'm not trying to limit you.

A Right. 11:08AM

Q I'm just trying to get a good understanding of what your testimony is going to be. Dr. Johnson, did you perform any of your own evaluation of phosphorus or bacteria contamination in the watershed, and when I say watershed or I say IRW, 11:09AM what I'm meaning is the Illinois River watershed at issue in this case.

A Okay. Understood. Well, I indicated to you that I looked at the raw phosphorus concentrations by way of making maps. So in that respect, yes. 11:09AM

0079

Q That was the report -- the samples and analyses collected by the State of Oklahoma in this case?

A No. This would have been data -- oh, yes. To the extent that the data produced by Dr. Olsen falls 11:09AM in that category, yes.

Q Okay. I wasn't clear. What I'm asking you, did you perform any of your field investigations in this case?

A Oh, no. 11:09AM

Q Why not?

A I was asked to look at the PCA that Dr. Olsen did based on the existing data.

Q Okay. So is it fair for me to understand that your primary role is to critique the opinion of Dr. 11:09AM Olsen on his PCA analysis?

A To understand what he did and evaluate the degree to which it did or did not support his opinions and conclusions.

Q For the PCA analysis? 11:10AM

A For the PCA analysis.

Q Did you evaluate any of the other opinions in Dr. Olsen's report?

A Peripherally but in the context of the degree to which it informed on the PCA. 11:10AM

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Q Okay, but you're not offering any opinions on non-PCA opinions in Dr. Olsen's report?
MR. GEORGE: Object to form.
A No. Again, to the extent that I call on a discussion in another part of his report that informs me on the PCA. 11:10AM
Q Okay. Are you offering any opinions as to what the major sources of phosphorus are in the Illinois River watershed?
A No. 11:10AM
Q How about sources of bacteria, same question?
A No.
Q Are you offering any opinions to critique any of the other State experts in this case?
A No. 11:11AM
Q Which of the State experts' reports have you reviewed?
A I reviewed Fisher's report, obviously nowhere in the detail I looked at Dr. Olsen's report. I'm trying to think if there are others. I believe there's either a letter -- I don't know if it's an expert report, but a letter from Harwood is an appendix in Dr. Olsen's report, which I have seen but I wouldn't say approached anything near a critical review. Those are the only ones I can 11:11AM 11:12AM
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think of.
Q Okay, and are you offering any opinions concerning Dr. Fisher's report?
A No, not specifically. I believe the poultry house density map, which I used as a base layer, if I read Dr. Olsen's report correctly, was actually work that was done by Fisher. So I guess secondarily, yes. 11:12AM
Q We'll get to that in a little while. Did you review Dr. Engel's report? 11:12AM
A I don't believe I did.
Q Do you know that Dr. Engel did a modeling analysis in this case to identify sources?
MR. GEORGE: Object to form. Answer, if you can. 11:12AM
A I knew there was modeling being done on the plaintiff's side. I wasn't sure if I could have told you it was Engel that did it.
Q Okay. Did you review Dr. Teaf's report?
A No, I have not. 11:13AM
Q Did you review any information involving the -- what I would call an analysis of the amount of bacteria that is in waste streams within the Illinois River watershed?
A Not that I recall. 11:13AM
0082
Q Did you review any material that relates to the amount of phosphorus that's produced in the Illinois River watershed?
MR. GEORGE: Object to form.
Q Let me restate that question. Let me strike that question. Did you review any information concerning a phosphorus mass balance for the Illinois River watershed? 11:13AM
A There was a mass balance argument that was brought into Dr. Olsen's cattle impact argument 11:14AM

calling back from an earlier section of his report. I don't recall the degree to which phosphorus was within that mass balance. It was something I was aware of to the extent it impacted my review of those two paragraphs, but I was aware of it, but I did not go back and do a critical review of mass balance.

Q Do you remember reviewing any mass balance analysis performed by Dr. Engel or Meagan Smith? 11:14AM

A No, I do not.

Q Have you ever been involved working on a source analysis where the sources of pollution involved non-point sources?

A Yes.

Q Which cases? 11:14AM

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A The dioxin cases. The -- one potential source for dioxins are combustion of any number of things, and the nature of combustion is it ends up being distributed in what I would call a non-point source, although it probably came out of a specific tailpipe at one point. The way it's distributed in the environment would be -- I think would be more in line of with what we consider non-point source. 11:15AM

Q Because it's an aerial distribution from the incinerator?

A Incinerator, exhaust, something like that, yes.

Q Right. Okay. Any other case that you have done a source evaluation involving non-point sources? 11:15AM

A None that pop to mind.

Q Okay. Is it fair for me to say that the only case on source analysis involving inorganics as opposed to organic contaminants was the chromium case we discussed? 11:16AM

A No. I've analyzed other inorganic datasets. I did a project looking at major ions in groundwater in Wake County, North Carolina as part of my PhD research.

Q Is that listed in your CV? 11:16AM

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A My PhD dissertation, it is, yes.

Q Okay. Other than the chromium case that's listed in your PhD dissertation, have you done any work with inorganic contaminant identification?

A Yes. 11:16AM

Q What others?

A When I was -- early on in my PhD work, I contacted a former professor of mine named Stan Riggs, who had a large inorganic sampling program going on, I believe in Albemarle Sound, North Carolina, and I worked on that data for quite a while, seeing how multivariate methods would react to that type of data. 11:17AM

Q Okay, and did you -- were you trying to identify sources in that case?

A I was trying to identify patterns. To the extent I could then link them to sources, I don't recall if we made it that far. In general, the reason it was never published is because it was a problematic dataset. 11:17AM

Q Other than the chromium case that we

discussed, since you received your doctorate, have you done any work on -- with inorganics and source evaluation?
A There's a paper on Page 72 of my report within the reference section, DorT, et al, 1996. That was a metals in sediments. Actually -- 11:17AM
Q Had to do with organic carbonate-bound metals?
A Yes.
Q Okay. Anything else? 11:18AM
A Bear with me a second while I look back at my vitae and to see if there are any others. One of these consulting expert projects that we were speaking of earlier, the focus was primarily dioxins, but in addition, they had analyzed for metals, and I believe at one point I probably had a task under that project to look at the metals data. 11:19AM
Q This is when you worked for the big consulting firms?
A Actually, no. This would have been consulting post -- 11:20AM
Q Doctorate?
A -- PhD.
Q Okay.
A But the main contaminant of concern was dioxins. There were just other chemicals out there, and at some point I'm sure we looked at the metals data. 11:20AM
Q This reference that you mention at Page 72 of your report where it's a published paper --
A Yes. 11:20AM
Q -- was that a source identification project?
A Again, that was the objective.
Q Were you able to identify sources in that particular study? 11:20AM
A Some of the patterns we saw were related to source. I'm pretty sure some of the patterns we saw were related to geochemical process.
Q Okay. Did you use a multivariate analysis on that case? 11:20AM
A Yes, we did.
Q Anything else; can you think of any of other projects where you focused on inorganic constituents in your source of contamination analysis?
A When you asked the question a couple of times ago, you -- at that point you started limiting it to PhD and not -- 11:21AM
Q Yeah. I think it's post PhD. That's my intent. Thank you.
A There was another -- there was similar to the Stan Riggs, Albemarle one. There may be others. I'd be glad -- if you want to spend the time, I can go back through my CV, but it's up to you. I may be able to add a couple to the list if you want. 11:21AM
Q Is it fair to characterize your experience as primarily related to organic contaminants? 11:21AM
A Yes, post PhD, that's -- did you say organic?
Q Yes.
A Yes. Chlorinated organic even more so.
Q Okay. Have you ever worked on -- I'm going to say a case -- I'm going to mean an investigation, a 11:21AM

source investigation -- involving agricultural pollution other than this case?
MR. ELROD: Object to form.
A Not that I recall. 11:22AM
Q How about nutrient pollution?
MR. GEORGE: Object to form.
Q Have you worked on a case other than this case that involved nutrients as the contaminants of concern? 11:22AM
A Not that I recall.
Q How about same question with regard to bacteria; prior to this case, have you worked on a case involving bacteria as a contaminant of concern?
A No. 11:22AM
Q And I assume by your earlier answers, the answer would be no, that you've never worked on a case involving poultry waste?
MR. GEORGE: Object to form.
A No, I've not. 11:22AM

0088

Q Or any other animal waste pollution?
A In our dioxin fingerprinting work, one of the patterns that we identified was consistent with the dioxin-furan congener pattern that's observed in sewage sludge, and so the answer to that would be yes. 11:23AM
Q And that would be the only instance?
A That's the only one I recall.
Q Okay. Have you been involved in a source identification project where you are looking for pollutants or sources of pollutants on a watershed-wide basis? 11:23AM
A Yes.
Q Which cases are those?
A That would have been -- would not have been an inland watershed such as this, but within my CV there's reference to a couple of papers from early to mid '90s where we were looking at dioxins and furans in Newark Bay, Passaic River, Hackensack River, Arthur Kill, basically metropolitan New York. 11:23AM 11:24AM
I wouldn't say it's -- certainly in terms of scale of watershed, it was a pretty large scale.
Q Have you been involved in an inland watershed investigation similar -- like the Illinois River watershed? 11:24AM

0089

A I've been involved in stream studies inland. The Union City is an example. Watershed -- inland watershed of this size, no.
Q Have you been to the Illinois River watershed?
A Yes. 11:24AM
Q When was that?
A Mid July of 2008.
Q Any other occasions other than last summer in July?
A Actually in the watershed, no. 11:24AM
Q Okay. When you went to the watershed, did you make any observations?
A I was there for a full day. I saw -- I'm not sure what you mean by observations but, yes, I observed a lot. 11:25AM
Q Okay, and what did you observe? Did you get like a tour of the watershed?

A I got a tour, yes.
Q Okay. What were you shown?
A We -- on the first day or first part of that day, there was me and two other scientists retained by the defendants whose names I don't recall. We were given a tour of the watershed by air, flying out of Siloam Springs. I don't recall the exact route we took, but I know that we went south and 11:25AM
west over Lake Tenkiller and back up towards Fayetteville to the east of Siloam and eventually back to the airport.
Q How would you characterize the land use as you observed from the air on this trip? 11:26AM
MR. GEORGE: Object to form.
A I saw wooded areas. When we were over Fayetteville, I saw urban areas. When we were over the lake, I saw wooded and agricultural. I saw agricultural in the -- agricultural in a number of 11:26AM
places as well.
Q Would you characterize as most of the watershed you observed was either agricultural pasture or forest?
MR. GEORGE: Object to form. 11:26AM
A I was not calculating percentages in my mind, but there was a lot of agricultural and forest.
Q Do you have any knowledge of what the relative percentages are of land uses within the IRW?
A Not of an exact percent, no. 11:27AM
Q Is that type of information helpful in source identification projects?
MR. GEORGE: Object to form.
A It certainly could be if you're -- yes, it certainly could be. 11:27AM

Q As part of your analysis in this case, did you review any photographs?
A Yes.
Q Can you describe those for me, please?
A There were photographs, air photos as figures 11:28AM
in the back of Dr. Olsen's report. There were photos from field investigations, a lot of photos from field investigations. I did not come close to looking at all of them, but I did seek out to find the photographs that showed the cow pasture sampling 11:28AM
in March of 2008. I definitely looked at those field photos.
One of the experts on -- for the defense undertook a project where they went out to places where edge of field samples were collected, and they 11:28AM
put together packages that included photographs of those locations.
Q So you saw photographs of edge of field sampling?
A No. I saw photographs of places that -- based 11:29AM
on the lat-longs that people in the field presumed were the places where edge of field samples had been taken perhaps one or two years before.
Q Okay. Did you -- oh, that was done by the defendants. Did you review any of the photos 11:29AM

collected by the State in this case, the plaintiff, on edge of field sampling?

A Yes.
Q Okay, and did you -- what did you observe in those photos? 11:29AM
A Well, the ones that I recall, again, were the cow pasture edge of field samples. I recall that there was -- I forget the exact sample numbers but -- I seem to recall CP-1A and CP-1B. I found photographs that indicated where those were being 11:30AM collected. One of them was -- I think CP-1B was labeled CP-1A, but for lat longs it was under that label, indicated it was actually CP-1B. Either that or the nomenclature may have been switched. Those two are the main ones I recall looking at. 11:30AM
Q Do you recall any photos of runoff from land-applied fields with poultry waste?
A I don't recall seeing those photos, no.
Q Did you have access to all the photos that the plaintiffs have taken in this case? 11:30AM
A I don't know. There were a number of field photos that were available. I don't know if that's an exhaustive list or not.
Q Do you recall seeing any photos of edge of field samples being taken on poultry fields? 11:30AM

0093

A Not that I recall.
Q The case that you identified as a non-point, potential non-point source pollution involving dioxins --
A Uh-huh. 11:31AM
Q -- was the dioxin pollution from that particular source considered a significant contributor to the pollution in that case?
A Well, in the one case, it was one of four or five patterns to be identified. So depends on your 11:31AM definition of significant. This issue also came up in the Grenada, Mississippi litigation.
Q For the wood treatment plant?
A For the wood treatment plant, but the theory of the defendants in that case was that the dioxins 11:32AM were from combustion sources rather than from pentachlorophenol.
Q And those cases involved soil media?
A The Mississippi case involved soil. The other consulting expert case involved sediment within a 11:32AM watershed.
Q Have been -- have you been involved in evaluating non-point source pollution where the media of concern was surface or groundwater?
A Yes. 11:32AM

0094

Q Which case is that?
A The major ion inorganic geochemistry project in Wake County, North Carolina that I spoke of earlier, that was groundwater. The chlorinated organics -- let me make sure I'm clear on the 11:33AM question. You want groundwater --
Q Non-point source.
A Groundwater non-point, both of those at the same time or one or the other?
Q I'm asking about non-point source work you've 11:33AM done --
A Okay.
Q -- in either groundwater or surface water, but

I want to understand your evaluation of non-point source pollution as it relates to contaminating groundwater or surface water.
MR. GEORGE: Object to form.
A Well, the Wake -- Chatham, Wake County, North Carolina site, the patterns we identified were not point sources. So in that instance, they were non-point sources. 11:33AM
Q And what was the contaminant in that case?
A They're -- actually what we were identifying were fingerprints related to the natural geochemical variations in the water related to rock types and -- 11:34AM

0095

Q What I'm looking for is pollutant sources.
A Pollutant sources.
Q Usually I say by a point source or non-point source. My terminology is typically a pollutant source. 11:34AM
A Okay.
Q An anthropogenic source.
A Anthropogenic source. Non-point in a watershed?
Q Yeah. I'm looking for your experience in identifying non-point source pollution in either groundwater or surface water. 11:34AM
A Outside of the combustion issue, the non-point combustion dioxin source, I can't think of one.
Q When were you retained in this case? 11:34AM
A In late April or early May of 2008.
Q And who retained you?
A I was retained by -- I guess the best way -- a group or consortium of the defendants. The actual contact for the retention agreement was Steve Jantzen at -- I keep forgetting the law firm's name. 11:35AM
Q And who instructed you as to your objectives in this case?
MR. GEORGE: Object to form.
Q Were you given objectives in this case? 11:35AM

0096

A I was given the general objective of evaluating the degree to which the principal components analysis that Dr. Olsen ran supported his opinions, and I don't remember who first expressed that objective. It may have been Jay Jorgensen; it may have been Robert George. 11:36AM
Q Were you given any other objectives other than the general objective?
A Not that I recall.
Q And which lawyers have you had most of your contact with? 11:36AM
A I'd say Robert George and Jay Jorgensen would be the two that come to mind immediately.
Q Okay, and why did you have contacts with these gentlemen? 11:36AM
MR. GEORGE: Object to form. Go ahead.
A Robert George -- I forget the designation that's used, but each of the defendants has an attorney who is primarily responsible for working with us technically. Robert George was that designated person for me. 11:37AM
Q For you?
A Yes.
Q Let me hand you what's been marked as Exhibit

2 and if you could take a look at that exhibit and 11:37AM

0097

identify it for me, please.
A This is the retention agreement that I signed and sent back to Steve Jantzen. It refreshes my memory that the law firm is Ryan, Whaley, Coldiron & Shandy. 11:37AM
Q Okay, and this indicates that you were retained by Tyson -- I'm looking at Page 2, the first -- well, the second page of the exhibit, but on the top of Page 3 of the exhibit it says you may become a joint defense expert. Do you see that? 11:37AM
A Is this Bullet 3?
Q Yes, sir.
A Oh, yes.
Q Is it your understanding you're a joint defense expert in this case? 11:38AM
A Yes.
Q Okay, and under there, fees and expenses, it mentions your labor cost at $175 per hour and 225 per hour for testimony; correct?
A Correct. 11:38AM
Q Has that been your hourly rate throughout this case?
A Yes.
Q And is it still your hourly rate?
A Yes. 11:38AM

0098

Q Okay. Can you tell us how much you've billed the defendants in this case to date?
A I cannot give you an exact number.
Q Can you estimate it for us?
A I would say it's slightly over a hundred thousand dollars. 11:38AM
Q Okay, and if you look at the last page of the exhibit, is that your signature on the last page?
A Yes, it is.
Q And for compensation, did you submit invoices to the defendants for reimbursement and payment for your services? 11:39AM
A I would send invoices to Steve Jantzen who this letter is from, and for -- I can't remember the case here -- Ozark International Consultants, so copies would go to both of them. 11:39AM
Q Okay, and who paid your invoice?
A The check that's come says Ozark International.
Q Let me hand you what's been marked as Exhibit 3. Can you identify that for me, please, sir? 11:39AM
A Yes. This looks like a package of invoices that I've submitted to Ozark.
Q The top invoice appears to be dated around October 6th, 2008; correct? 11:40AM

0099

A Correct.
Q It looks like it's actually for September time. Have you invoiced the defendants for work since September?
A Yes. 11:40AM
Q Did you include those in your considered materials?
A The most recent one here is October 6th. I think that the one that would have been sent out at

the beginning of November is probably included in my produced materials. The ones after December 1st I don't think have been produced. 11:40AM

Q Have you done any work on this case since December 1st?

A Yes. 11:41AM

Q What kind of work have you done since that time?

A December and January was very limited, an occasional conference call, and then in February, it was this deposition and associated preparation. 11:41AM

Q Have you done any additional analysis concerning your objectives as you were given in this case?

A No additional analyses.

Q What was the subject of the conference calls in December and January? 11:41AM

A The ones in December and January were pretty short and sweet, typically less than ten minutes. They were coordination calls just to let everybody know what was going on, which for us in December and January was not much, so most of those calls were less than fifteen minutes, less than half an hour. 11:41AM

Q Were you informed that you were required to retain all the materials you received or reviewed for your work? 11:41AM

A Not specifically, but I think I presumed that.

Q Okay. Did you retain all of the work that you reviewed or sometimes we use the term considered for your opinions in this case?

A Yes. 11:42AM

Q And did you produce it to counsel for production to the State of Oklahoma?

A Yes.

Q Did that include all the E-mails and other communications with counsel and other experts? 11:42AM

A Yes, I think so.

Q Have you had any discussions directly with any representative of a client other than a lawyer in this case?

A Oh, you mean like other experts, other consultants? 11:42AM

Q No, sir. Actually I was referring to client representatives like employees or officers of Tyson or Simmons or --

A Oh, no. 11:42AM

Q -- anything like that?

A Not that I recall.

Q So your communications have been with counsel or other experts; correct --

A Yes. 11:42AM

Q -- best you know? Okay. Now, in this case did you have regular calls with the experts?

A Yes.

Q And I guess that included counsel also; is that correct? 11:43AM

A Yes.

Q How were those calls facilitated?

MR. GEORGE: Object to form.

A There was typically an E-mail sent out with a call-in number and an access code and the time of 11:43AM

the call, and then you would call in and join the call. Is that what you mean by facilitated?
Q Uh-huh.
A Okay.
Q Were any materials ever reviewed in those 11:43AM
calls?
A Yes.
Q And how were they reviewed; how did you get access to those materials?
A If somebody was presenting aspects of stuff 11:43AM they had found, it was often done as a WebEx conference call where people join in on the phone and somebody would have control of the computer and show things that they were working on.
Q Okay, and did you produce the materials that 11:43AM were provided through the WebEx?
A I didn't. If somebody else was presenting on WebEx, I didn't have those materials in my possession to produce.
Q Okay. So those -- some of these materials 11:44AM were materials that you considered in your evaluation for your report?
MR. GEORGE: Object to form.
A I think I would say I considered them in that I was aware -- it made me aware of aspects of the 11:44AM project that other people were working on.
Q Did you rely on any information you provided that was shown on an image through -- I guess it's an FTP site; is that what --
A It wasn't an FTP site. It was a web-based 11:44AM service.
Q Okay. There was an image, an electronic image?
A Yeah, it was an image, yeah.
Q Did you use any information from any of these 11:44AM electronic images as part of your evaluation in this case?
A Again, no. Primarily it was the extent of understanding what other people were doing and what conclusions they were coming up with. I tried to 11:45AM avoid in my report relying on an image that I saw on a screen for a fleeting instant, just in case I didn't remember it, didn't recall that image correctly, so --
Q How did you get the information concerning Dr. 11:45AM Cowan's opinions in this case?
A He had one of these conference call WebExes where he discussed his report.
Q And he showed the report on the screen?
A He showed the report on the screen, yes, 11:45AM exactly.
Q And is that the basis for your reference to Dr. Cowan in your expert opinion, that discussion and image shown on the screen during the WebEx conference call? 11:45AM
A Yes.
Q Did you ever get a hard copy of that report to produce as part of your considered materials?
A No. I believe those -- I believe those reports were put on the FTP site or web server, but 11:46AM

I never downloaded Chuck's report and read it.
Q Okay, and do you know whether that report that you saw was a draft for his final report?
A Well, the conference call took place before December 1st, so I think it would be characterized as a draft. 11:46AM
Q Let me hand you what I've marked as Exhibit 4, and let me ask you if you can identify that for the record.
A I'll do some housekeeping here. 11:46AM
Q That's fine.
A Yeah. This is an E-mail sent by Jennifer Benaman of QEA to a number of experts with scheduling information on upcoming conference calls.
Q Okay. So in this case it looks like you had a call every week; is that fair? 11:47AM
A This one, if you'll see on the calendar, coordination, it appears usually Thursdays at 3:00. That was pretty much of an every-week call. I'm sure there were exceptions but -- 11:47AM

0105

Q And then you had additional calls, for example, in September on fingerprinting source allocation, on September 8th?
A Yes.
Q And it was always through this WebEx procedure? 11:48AM
A Yes.
Q Let's turn to the page -- it's marked Glenn Johnson 0084.
A Okay. 11:48AM
Q Do you see under fingerprinting in the upper left-hand corner of this page?
A Yes.
Q Who does it list under presentations for fingerprinting? 11:48AM
A 1:00 Larson lists Connolly, Johnson, Morrison and Sullivan.
Q Okay. So there was a -- was there a call on fingerprinting on September 8th, 2008?
A There was one about that time. I assume -- I have no reason to believe this calendar isn't how it happened. 11:48AM
Q Okay. I got this from your materials.
A Okay. I don't remember the exact date.
Q Fair enough. Do you recall the call? 11:49AM

0106

A Not with encyclopedic recall but, yes, I recall we had a fingerprinting call around that time, yes.
Q Do you know who Larson is?
A Steve Larson is with S. S. Papadopulos in Washington, D.C. 11:49AM
Q What was his contribution to the call, his presentation at 1:00?
A I don't recall, but my recollection is the way this -- the way this is laid out, that he was presenting material that he had found and was currently working on within his draft report. 11:49AM
Q Okay. Do you know whether or not Mr. Larson submitted a report in this case?
A I presume that he did. I've not seen it. 11:50AM
Q Was there any information from Mr. Larson's

presentation that was important to you in your evaluation?
A He was dealing primarily with groundwater. My recollection is that he was discussing PCA-related issues, and the main reason for us being on the call was to -- is to -- is just to see what each of us were saying about those similar topics. He was talk -- he had a lot within his report that went beyond that realm, and those I don't recall much about at 11:50AM
all.
Q Okay. What do you recall about the PCA-related issues that he discussed that day?
A He had done -- since he was focusing on groundwater, he had gone back and plotted some of 11:51AM the raw scores from Olsen's produced materials from SW -- I forget which one it was -- SW 17 I think was the groundwater and surface water model, and I think perhaps at that conference call he showed score plots that he had reproduced from those results. 11:51AM
Q Okay. Was that information helpful to you in preparing your report?
A Only in that I didn't see anything within what he had done that made me go back and change. It was helpful to see that we were on the same page. 11:51AM
Q And do you have copies of that report?
A No, I do not.
Q What about Mr. Connolly; do you recall what his presentation was concerning? I guess fingerprinting also? 11:52AM
A Yes. Again, I've not seen Connolly's final report yet, but I know he was working on issues, fingerprinting, related more to direct analysis of phosphorus and individual analytes than a multivariate approach. 11:52AM
Q Okay. Do you know whether he did any multivariate analysis?
A I don't recall. Not that I recall.
Q Do you have notes from this phone call?
A No. 11:52AM
Q You didn't take any notes?
A No.
Q Were you instructed not to take notes?
A No.
Q Have you ever looked at Dr. Connolly's report? 11:52AM
A No.
Q A draft of Dr. Connolly's report?
A I'm sorry?
Q A draft of Dr. Connolly's report, have you reviewed a draft of Dr. Connolly's report? 11:52AM
A I joined -- I don't know if it was this conference call or maybe a subsequent one, but I joined a conference call where he was showing his draft report on WebEx. I've never seen it -- I've never read it in hard copy and downloaded the final. 11:53AM Oh, you're asking about drafts anyway, so, yes, in that sense on a WebEx call I saw his draft.
Q Did you read what was on the screen?
A I only joined for a short time. I believe, my recollection is accurate, his charge is across a 11:53AM broad technical range that went well beyond PCA.

Q I guess my question was, did you read what was up on the screen?
A Well, yes, but I guess where I was getting off on a tangent is that I only joined for a short time when he was discussing things that were relevant to the PCA. So to the extent that he showed other things during however that call did, I can't comment on because I wasn't on. 11:53AM
Q Okay. When Dr. Larson put his materials up, did you read what was on the screen? 11:54AM
A Yes.
Q Okay. Then I guess you got on a third at 3:00. What was your presentation about?
A I believe I probably showed where I was with my draft report, some of the key figures, and probably some of the things that -- well, I'm sure with the people that were on here, I don't recall specifically, but I'm sure that basically we were trying to show parts of our work that were -- that had possible overlap with their work. So I don't recall specifically what I showed them when I showed my stuff, but -- 11:54AM
Q Did you receive any comments from anyone?
A Not that I recall. 11:54AM

Q Did you recall making any comments on either Dr. Larson's or Dr. Connolly's presentation?
A I remember on Larson's when he was showing the PCA scores plots, I just -- I immediately just saw this actually after that. I made it clear to him that I was also addressing the SW17 PCA run. 11:55AM
Q Did you compare notes?
MR. GEORGE: Object to form.
A Well, his -- his plot of the PCA was consistent with mine, so to that extent, yes. 11:55AM
Q Anything else?
A Not that I recall, no. Are we done with this guy?
Q As far as I know. You're welcome to put it down. Let me hand you what's been marked as Exhibit No. 5. Can you identify that for the Record, sir? 11:55AM
A This is an E-mail from Jay Jorgensen, Sidley & Austin, to a number of people on the project, and looks like it's listing some of the coordination call times, but in addition to that, there's an attachment with names of different people working on the project. 11:56AM
Q I want to focus on that attachment?
A Okay.
Q Which starts at the -- I believe on Page 3 of the exhibit, does it not? 11:56AM

A Uh-huh.
Q Who is Charles Andrews, if you know?
A Sorry. I had the wrong page.
Q Yeah. Thank you. 11:56AM
A Well, I see here he has a Papadopulos E-mail, but I've not talked to him that I recall.
Q Have you received any communications whatsoever from Mr. Andrews? 11:57AM
A Not that I recall.
Q Did he make any comments on your report?
A I don't even recall if he was on the

conference call when we discussed my report.
Q Who has made comments on your report; did anyone make comments on your draft reports? 11:57AM
A Yes.
Q Who did?
A One comment I recall from -- was from Robert George, much of the material that is now -- that appears within Appendix A, kind of a mathematical 11:57AM
summary, was originally in the introduction of the report, and it ended up getting bigger and bigger, to the point that you were a number of pages into the report before you actually got to the issues of opinions and conclusions. So in a conversation we 11:58AM

0112

had, we -- I don't remember if it was his suggestion or my suggestion. We decided that it would make sense to move that information to an appendix so that we still had it but the report itself would get to the salient points faster. 11:58AM
Q Do you recall any other comments from Mr. George?
A No, I don't.
Q Do you recall receiving comments from any other of the lawyers in this case on your report? 11:58AM
A Trying to think what other lawyers were even on the call. I believe Scott McDaniel was on the call. I don't recall any specific comments from Mr. McDaniel, though.
Q Anyone else? 11:58AM
A No, not lawyers.
Q Okay. What about other people that worked on this project with you; do you recall anyone else providing any comments on your report? When I say report, I mean just your opinions, analysis. 11:59AM
A Okay. Well, others that were on my call, I remember Tim Sullivan and John Connolly were on for at least parts of it.
Q Do you recall them making any comments on your -- 11:59AM

0113

A I remember Tim Sullivan making comments that it all fell into sort of the category as we'd come to the end of a section, comments similar to that's all good stuff, we need to tie it up with a summary sentence or summary paragraph that drives the point 11:59AM
home, and the reason that one sticks with me is because that was the comment that seemed to always come out of Tim.
Q Did he provide any other type of comments other than these I'll call editorial-type comments? 12:00PM
A No.
Q Nothing substantive?
A Not really. I mean, there were times when it was necessary to -- it was nice to have somebody who didn't understand PCA as well I did who could help 12:00PM
identify when I was getting a little bit too much into jargon and would identify places where we needed to make the text more lucid so the point comes out instead of just the jargon.
Q Anybody substantive? 12:00PM
A As far as changes to the opinion, no, no.
Q Or the analysis?
A No.

Q Okay. What about Mr. Connolly?
A No substantive changes to the opinion or analysis, no. 12:00PM

Q Did you have any colleagues on the -- I'll call it the defendants' consultant team that understand PCA as well as you do?
A Yes. Chuck Cowan. 12:01PM
Q Anyone else?
A I wouldn't put anybody else on our team in that class.
Q Do you know of anyone else that actually did any PCA analysis as part of their professional work? 12:01PM
I'm just asking if you have -- if you can identify any of the experts that did any PCA analysis as part of their professional work.
A You mean in general or this project?
Q Either. 12:01PM
A I don't know of anybody else who were on those calls that did a PCA. I know that Connolly is familiar with PCA, and I didn't have to do any -- I didn't have to do a whole lot of remedial education to tell him where all of this was coming from. 12:01PM
Q What about Mr. Larson? You mentioned earlier that he did some PCA.
A Yes. Steve --
Q Did you find he wasn't competent in doing PCA analysis? 12:02PM

MR. GEORGE: Object to form.
A No, I didn't find that at all.
Q Okay.
A And what Steve was doing was taking the scores plot and replotting them on an X-Y graph, and I think that's something that any number of people that don't have any experience in PCA are fully capable of handling. 12:02PM
Q Do you know whether or not he actually ran PCA analysis as part of his work? 12:02PM
A No, I don't.
Q Let's go back to this list here.
A Okay.
Q What about Dr. Banner; have you worked with him at all in this case? 12:02PM
A No.
Q How about Dr. Bierman?
A He's been on the coordination calls, but I've not worked with him closely.
Q Do you know what work he's doing on this case, his subject areas? 12:02PM
A I believe he's addressing the modeling but --
Q Have you seen any of his work product?
A No.
Q Been involved in any cases -- any presentations by Dr. Bierman? 12:02PM
A I don't think so, no.
Q Okay. What about Mr.Chadwick; what can you tell me about him?
A I know he's been on some of the coordination calls. I didn't join any of his specific calls. I don't think he joined mine. We've not worked closely together on this. 12:03PM

Q Kathleen Suler?
A Same as Chadwick, very little, if any, contact. 12:03PM
Q What about Jay Churchill?
A I've not worked with him on the project. There were -- when we did the airplane flyover of the basin, I was with two biological types, and I think Jay may have been one of them, but I'm not even confident; I'm not even sure of that. 12:03PM
Q Do you recall hearing any presentations by Mr. Churchill?
A No, I don't. 12:04PM
Q Do you recall reading any of his report work in this case?
A No.
Q Do you know what subject matters he worked on this case? 12:04PM

A My recollection is he's a biologist, but I'm not sure about that.
Q What about Alan Cibuzar?
A I've not worked with him.
Q Okay. Billy Clay? 12:04PM
A Clay has been on the conference calls, and I believe I contacted Clay once. As I sit here, I don't remember what that was about.
Q Do you recall receiving any materials from Mr. Clay? 12:05PM
A No.
Q Any information?
A No.
Q Do you know whether or not Mr. Clay did an analysis concerning the amount of phosphorus that would be generated by livestock within the watershed? 12:05PM
A I don't recall that specifically but now that you mention it, I think that is -- I think -- maybe you jogged my memory. I think that's the type of stuff he did, livestock related. 12:05PM
Q Did you review his work in that regard?
A No, I did not.
Q Would that not have been helpful to you in doing your source evaluation and critique of Dr. Olsen? 12:05PM

MR. GEORGE: Object to form.
A I don't think it was critical to doing my review of Dr. Olsen's PCA.
Q Would it have been helpful? 12:05PM
MR. GEORGE: Object to form.
A I don't -- I can't comment on whether something I haven't seen would be helpful.
Q Well, let me ask you this: If you had some information available that would identify which sources produced the most of a contaminant of concern in an area you're investigating, wouldn't that information be probative to your analysis? 12:06PM
MR. GEORGE: Object to form.
A Could be. 12:06PM
MR. PAGE: I see we're almost out of time. Let's take a break here.
VIDEOGRAPHER: We are now off the Record. The time is 12:06 p.m.

(Following a lunch recess at 12:06 p.m., proceedings continued on the Record at 1:09 p.m.) 12:07PM

VIDEOGRAPHER: We are now on the Record. The time is 1:09 p.m.

Q Dr. Johnson, before lunch we were reviewing Exhibit 5, and we were looking at a contact sheet looked like to me, and I'm not going to be able to go through all these folks, but there's just a couple more I want to ask you about. 01:10PM

A Okay. 01:10PM

Q There's a Remy Hennet. I guess it's Bates numbered Glenn Johnson 04222.

A Yes.

Q Did you ever work with Mr. Hennet?

A We had one conference call early on in my involvement in the project that involved Remy, and that was the extent to which I've worked with him. 01:10PM

Q Did you review any of his work in the preliminary injunction?

A I think I saw an affidavit of his, which I read and reviewed. 01:10PM

Q Okay. He also did some PCA analysis, did he not?

A I don't recall.

Q Okay. Do you recall that the subject matter of your discussion was such that you were retained in this case? 01:11PM

A He had looked at the PCAs -- PCA analysis issues during the preliminary injunction, and if I recall, the nature of that conference call was just to have -- to discuss where I was at that early part of my evaluation in the PCA and to hear comments from him if he had any. 01:11PM

Q Did he provide any criticisms of Dr. Olsen's method on a PCA when you visited with him? 01:11PM

A I believe he did.

Q Do you recall what those criticisms were?

A No, I don't.

Q And that was just the only conversation you had with Dr. Hennet, the one we're referring to, just one? 01:11PM

A I'm sorry?

Q Excuse me. I'm sorry. Just one conversation with Dr. Hennet?

A Yes. 01:12PM

Q Any other interactions like through this web meeting?

A I don't recall him ever being on any of the WebExes that we talked about this morning up to that point. 01:12PM

Q Okay. I see John Gipson.

A Yes.

Q Who is John Gipson?

A He is an employee at DPRA, a company near San Diego. Well, he was a guy working in a GIS lab. 01:12PM

Q Okay. Do you know what DPRA is?

A Yes. It's a consulting firm.

Q Okay. What was their function in this case, if you know?

A I'm not sure the extent to what they were asked to do but, they were -- part of their charge was to get produced GIS files from produced materials, and I think they might have put together a GIS project, I don't know, but the reason I knew that they did that is because I got some of the GIS files from them. 01:12PM 01:13PM

Q What files, GIS files did they provide to you?

A They -- I'm not exactly sure which ones were provided through them and which ones I may have gotten through other sources, but I believe some of them were through them. 01:13PM

Q What files?

A The one that I recall did come through DPRA was the poultry density base layer that I used to -- for the maps in my report. I believe that came through DPRA. 01:13PM

Q And that's the one you attribute to Dr. Olsen?

A The file name that they sent to me actually had Fisher on it. So I don't know if it came from Fisher's considered materials or Olsen's considered materials or even the degree to which they differ because Olsen's report indicates that Fisher did the poultry house density calculations. 01:13PM

Q So that map that you use in your report -- several times in your report to do the criticism of Dr. Olsen's spatial analysis was this GIS map that you got from DPRA? 01:14PM

A I believe the shape files were, yes.

Q Well, the -- for example, on Page 17 of your report, Figure 2-5. 01:14PM

A My report went someplace during lunch with my copy of the exhibits.

MR. GEORGE: Here it is.

A Is that mine?

MR. GEORGE: Apparently. I wondered why I had two. 01:14PM

A Okay. Sorry. Which page?

Q Page 17.

A Yes.

Q So the -- so this map that's shown in Figure 2-5 of your report is the density information you used for your analysis of Dr. Olsen's spatial analysis; correct? 01:15PM

A Yes. It came from shape files, GIS format shape files. 01:15PM

Q Okay, and I notice here you say, this poultry house data were produced as GIS shape files by Olsen in his production of materials relied upon. I believe you just -- that shows in the caption there on 2.5. 01:15PM

A Yes.

Q Are you sure that this was one of the maps that was relied on by Dr. Olsen in his analysis?

A This is -- if I recall correctly from Olsen's testimony, there may have been multiple iterations of versions of this map. For the most part, this map looks very much like the one in Olsen's Figure 2.5-1. There are a couple of subbasins in color where the shape files I received was slightly different. 01:15PM 01:16PM

Q And the one that's referenced in Olsen's 2.5-1, do you know what the origin of that information is?
A I believe there's reference in the text that it came from Fisher, but beyond that, I did not see it linked to a specific set of GIS files by name. 01:16PM
Q Do you know whether that information came from an Oklahoma State University analysis that was done in 2001?
A I don't know that, no. 01:16PM

Q Do you know whether or not this particular density analysis that's on Figure 2.5 of your report is the same density analysis that Dr. Fisher used in his expert report?
A No, I don't. The file name that came to me -- it didn't come to me. The files that I got from DPRA, the file names I believe had the word Fisher in it and something like revisions Juno 6 or something like that. So based on that, my assumption is it's data that came from Fisher. 01:16PM 01:17PM
Q You didn't do any additional analysis or investigation to determine the source of the information that's used for poultry house density in Figure 2-5?
A No, except my understanding, that DPRA got it from produced materials. 01:17PM
Q That's what DPRA told you?
A I believe so, yes.
Q Who is Bob Morris?
A Bob Morrison is also with DPRA. He's an employee there and also a person that I knew before this project. He was an editor on the books that I've published some chapters in, and he's organized environmental forensics conferences at different places in the U.S. and around the world that I've 01:17PM 01:18PM

participated in as a panelist or speaker.
Q What was Bob Morrison's function in this, if you know?
A Bob was doing things beyond GIS, but I'm not completely sure of all that he was asked to do. I know that he was looking at some of the soils and soils data, but beyond that, I couldn't be very specific. 01:18PM
Q Did he provide any information to you?
A Not as far as data or information that -- I'm sure we talked at some point and he probably mentioned -- mentioned things but he didn't like send me -- he didn't provide me with material that I recall. Oh, wait. No, no, that's incorrect. He -- when we were looking at -- when I was trying to put together the GIS files in order to make some of these maps, Bob -- this would have been early to mid July. At that point I pretty much had most of the base layers that I needed to put the maps, like locations of cities and streams, the poultry house density and -- but he sent to me a hard drive that had all of DPRA's GIS files up to that point, and that is in my produced material, so I did get that material from Bob. 01:18PM 01:19PM 01:19PM
Q Anything else? 01:19PM

A I think also in that material was the transcripts from the preliminary injunction. I'm not sure why they were included in that, but that material came from Bob Morrison as well.
Q Anything else? 01:20PM
A Not that I recall.
Q Did some of the material you received from DPRA include aerial photographs of the IRW?
A Yes. There was some images that were sent to me in the fall that were of the IRW. 01:20PM
Q Did you use any of those aerial photographs in your analysis?
A Yes, I reviewed them.
Q Did you use them for any of your analysis?
A Those maps showed -- those air photo-based 01:20PM
maps ended up showing the same thing I ended up showing, the figures that I drafted myself. So to the extent that -- and there was -- and I believe that DPRA generated those figures using the same
base layers, so, yes -- so I guess the answer is 01:21PM
yes.
Q Do you know the State of Oklahoma took aerial photographs of the IRW in 2005 for this case?
A No, I didn't know that.
Q You were not provided that as part of your 01:21PM

0127

materials to review?
A I was not denied access to anything. I don't believe I knew of their existence until you represented it to me and I don't believe I
downloaded such information from any of our sources. 01:21PM
Q Would that information have been helpful in your analysis?
MR. GEORGE: Object to form.
A I don't know how to comment how something I
haven't seen might be helpful but -- 01:21PM
Q Well, you said you did review some aerial photographs; correct?
A Yes.
Q Okay. Well, how did you use those aerial
photographs; what was the -- let me strike that. 01:22PM
What was the -- what use did you make of the aerial photographs that you --
A Well, the aerial photographs were a base map upon which the DPRA guys were plotting some of the
data and information that they had. So I would say 01:22PM
to characterize how I used them is -- well, I -- how DPRA used them was as a base map for photos that they -- for maps that they were putting together.
Q Did you -- did you personally use the aerial
photos in any other manner other than just as a base 01:22PM

0128

map?
A Not that I recall.
Q Who is John Gipson?
A Didn't we ask that already?
MR. GEORGE: Uh-huh. 01:22PM
A He's a DPRA, a GIS guy.
Q I'm sorry if I repeated. Are you familiar with the constituents that make up poultry feed?
MR. GEORGE: Object to form.
A I've familiar with the analytes that were 01:23PM
analyzed in -- within the -- I'm sorry, what was the

question again, within poultry feed?
(Whereupon, the court reporter read back the previous question.)
A I'm sure if you gave me a list, there would be chemicals on that list that I was familiar with. 01:23PM
Q Okay. Did you do any study or analysis of the chemical constituents of poultry feeds?
A No.
Q Do you agree, Dr. Johnson, that the constituents in poultry waste are impacted by their diet? 01:23PM
MR. GEORGE: Object to form.
A I would expect so.
Q Well, I judge by your testimony that you did not review any poultry feed analysis for your work in this case? 01:24PM
A Not that I recall.
Q Do you recall doing it any other time before this case? 01:24PM
A No.
Q Do you know whether or not poultry are produced in the IRW?
A Produced?
Q Uh-huh, grown. 01:24PM
A I know there are poultry houses in the IRW. I assume there are poultry growing inside of them.
Q When you went on your one or two-day trip --
A Right, one day.
Q One-day trip in the IRW, how many hours did you spend on that trip? 01:25PM
A It was a full day. We were up at the crack of dawn. We did the airplane flight first and then a driving tour the rest of the day.
Q When you were in your airplane flight, did you fly over any poultry houses? 01:25PM
A Yes.
Q And how did you identify the poultry houses from the air?
A I was -- I don't know if I was told by somebody in the plane, but I was told that these long like parallel rows of houses, that ones pointed out were -- I could, you know, use it to identify the next one. 01:25PM
Q Did you find that the poultry houses are sometimes in clusters of three or four? 01:25PM
A Clusters. I don't know if I would say they were always three or four.
Q Okay. So would your description of a poultry house from the air be a long narrow building that has a light colored roof? 01:26PM
MR. GEORGE: Object to form.
A Well, they're -- I think they're longer than they are wide, so that's the definition of long narrow. I don't recall the colors of the roofs and how light or dark they were. 01:26PM
Q Okay. What else did you see on this day trip?
A We stopped at a couple of places where we could walk down to the river's edge. We had lunch in Tahlequah. We visited the shore of the lake I believe in one or two spots. 01:26PM
Q Anything else?

A I know we passed near Watts.
Q Did you see any poultry houses from the ground view in your trip? 01:27PM

A Yes. We stopped at -- I do recall at least at one point we stopped on the road and we were -- there were poultry houses in the distance across a field.
Q Okay. Did you observe any land application of poultry litter? 01:27PM
A No.
Q Did you see any pictures of land application of poultry litter?
A I couldn't tell you where from, but I recall seeing a picture of a truck in some of the materials. It was labeled poultry application as a -- as a -- as the label of the picture. 01:27PM
Q Have you ever seen poultry litter up close?
A No.
Q Would you be able to describe it for me, its physical characteristics? 01:27PM
A Not based on firsthand observation.
Q What would you base any description of poultry litter on? 01:28PM
A Well, I've been told, I think by probably my clients, that it's -- that it includes not just chicken manure but also other material in the bedding. So given that, I guess I would have an expectation when I would see poultry litter, to see both aspects that appeared to be manure and aspects that appeared to be whatever makes up bedding. 01:28PM
Q You've never personally observed it or a picture of poultry litter?
A Not that I recall. 01:28PM
Q Okay. Would you know the -- what the particle size of poultry litter would be?
MR. ELROD: Object to form.
A The reason I'm hesitating is I don't know of anything that has a single uniform particle size. Various particles would be of different sizes. 01:29PM
Q Fair enough. Do you have an understanding of the range of particle size typically found in poultry litter?
A No. 01:29PM
Q Did you do any evaluation of the amount of poultry that's produced in the IRW?
A No.
Q Did you do any evaluation or review any materials concerning the amount of cattle that are produced in the IRW? 01:29PM
A No. I was not asked to do those types of evaluations.
Q Did you evaluate any animal populations in the IRW? 01:29PM

A There was -- one of the consultants had some cattle population density numbers that they had been working with, and I don't recall which consultant that was, but that also was made available to me in the format of GIS shape files. 01:30PM
Q Okay. Did you use this information as part of your report?

A No, I did not.
Q So you haven't made a study of the animal production amounts in the IRW, have you? 01:30PM
A No, I've not been asked to do that.
Q And have you reviewed any data that would relate to the different amounts of animals being produced in the IRW?
A Again, that's not what I was asked to do, so, no, I've not. 01:30PM
Q Okay. Did you do any evaluation of the chemical constituents in poultry waste?
A I did an evaluation of the data that Dr. Olsen represented in his report as being representative of poultry waste, which would have been the poultry litter samples within his ST-1 and I believe his ST-6 PCA runs and -- 01:31PM
Q Did you actually look at the analytical results for those samples? 01:31PM

0134

A Not that I recall. I mostly focused on the PCA results to the extent that it's discussed in my expert report.
Q Did you do any evaluation of the chemical constituents of cattle waste? 01:31PM
A Again, that was part of the same two principal component runs that included the poultry litter.
Q But you didn't look at the analytical results on the cattle waste itself?
MR. GEORGE: Object to form. 01:31PM
A I believe that I probably looked at the spreadsheets that contained that data. I did not spend much time reanalyzing that data as I did with the principal components analyses.
Q Did you find that there's a different chemical composition between poultry and cattle waste? 01:32PM
MR. GEORGE: Object to form.
A To the extent it's reflected on that PCA graph, yes. They plot in different locations on the PCA graph, which indicates that at least for the chemicals that are accurately back calculated in that PCA, they have different chemical compositions. 01:32PM
Q Did you do any evaluation of the chemical constituents in human waste?
A No. I don't know that I've seen data that -- 01:32PM

0135

that -- that shows that and, again, that was -- nor was it what I was asked to evaluate.
Q Did you do any evaluation, Dr. Johnson, about the amount of waste produced by poultry production within the IRW? 01:33PM
MR. GEORGE: Object to form, asked and answered.
MR. PAGE: My earlier question had to do with the amount of poultry, and this question has to do with the amount of poultry waste. 01:33PM
MR. GEORGE: Same objection.
A Again, no and, again, I was not asked to.
Q What about cattle waste; did you do an evaluation about the amount of cattle waste produced in the IRW? 01:33PM
A Same answer.
Q Swine?
A Same answer.

Q Human waste?
A Same answer. 01:33PM
Q Would you turn to Page 4 of your report, sir?
Under 1.3, opinions --
A Uh-huh.
Q -- would you read the last sentence of that
paragraph, please, under the first bullet? 01:34PM

A In addition, there are multiple other sources
not considered by Olsen at all, spray irrigation,
sludge application, biosolids application, nursery
runoff, golf courses, wildlife, swine lagoons,
septic systems, runoff from dirt roads and 01:34PM
commercial fertilizer application.
Q Did you consider the chemical compositions of
any of those sources in your analysis?
A I did not. I was not asked to do that. I was
asked to -- 01:34PM
Q I understand you may not have been asked.
A Okay.
Q That's fine. I just wanted to ask the
question.
A All right. 01:34PM
Q That's fair enough. I mean, you are only
responsible for what you were asked to do. Let me
ask another question. Did you do any evaluation of
the amount of waste that would be generated by each
of the sources you just read from in your report? 01:34PM
A No, I've not.
Q If that's the case, sir, then you don't -- you
haven't done a chemical evaluation of the waste from
those different sources, nor you do not know the
amount of waste generated from those sources. How 01:35PM

can you then be critical of Dr. Olsen for not
considering those sources?
MS. COLLINS: Object to the form.
A Well, for one, these things that I'm telling
you I was not asked to do, I believe he was. He was 01:35PM
asked to put together a PCA-based model that
identified sources. Number two, when I redid the
PCA, I came to the conclusion, based on my
reanalysis, that that was driving -- the signal that
was driving the two principal component model that 01:35PM
he presented was related to the basic geochemical
affinity of the analytes, specifically potassium,
chloride, sodium, sulfate, iron and aluminum, and so
the PCA story is not a story related to source, as
much as it is a story related to chemical affinity. 01:36PM
Q How can you know whether or not these sources
you listed would be important for consideration if
you don't know either its chemical composition or
the amount of that source that's generated within
the IRW? 01:36PM
A Because regardless of their chemical
composition, it's the affinity of the chemicals once
they start partitioning in the environment that is
driving this chemical system that is being analyzed
here. 01:36PM

Q So those sources aren't important for
consideration?
A They would be important for consideration if

there was a PCA signal related to source coming out of this analysis, which it's not. 01:36PM
Q So you don't believe it was important then for Dr. Olsen to review those different sources?
MR. GEORGE: Object to form.
A Had he recognized the particulate versus dissolved phase control on this system and indicated 01:37PM that that's what was indeed driving this system, I would have expected him to dismiss not only those sources but the sources he says he can't identify. To the extent that you can't identify those sources, I think it would take a different analyte list and 01:37PM higher numbers of principal components. My point is that he stopped -- he stopped too soon and he stopped at too simplistic an interpretation in order to get to the point where he could ask questions about these specific sources, as well as the 01:38PM specific sources that he says he did consider, such as poultry litter and wastewater treatment plant effluents.
Q Dr. Johnson, do you know whether or not poultry waste includes bacteria? 01:38PM

0139

MS. COLLINS: Object to form.
MR. PAGE: What was the problem with that objection (sic)?
MS. COLLINS: The characterization of waste. 01:38PM
MR. PAGE: Oh.
MR. GEORGE: That's been a longstanding dispute.
MR. PAGE: I'll give you that objection, standing objection if I use waste you don't want 01:38PM characterized.
MS. COLLINS: Thank you.
MR. ELROD: Why don't you quit using the word, then she won't have to --
MR. PAGE: Because I use my words carefully 01:38PM and accurately.
Q Anyway, Dr. Johnson, do you remember the question?
A No, I've been so entertained by the subsequent back and forth. 01:38PM
Q Do you know whether or not fecal waste from poultry contain bacteria?
A I would expect fecal material to contain bacteria.
Q Do you know whether or not poultry litter 01:39PM

0140

contains bacteria, used poultry litter?
A To the extent that it contains fecal material, I would expect that it might.
Q We were talking about the -- you said you reviewed some information concerning the chemical 01:39PM composition of poultry waste; is that correct?
A Yes.
Q Do you know of any other waste that has this same chemical bacterial composition?
MR. GEORGE: Object to form. 01:39PM
A Which bacteria; all of them? You mean, has them present in the exact same proportions as in poultry waste or has quantitatively completely different bacteria present?

Q Well, how would you prefer to answer the question? How would you prefer to characterize it? 01:40PM
A I would expect that there are certain bacteria species that are in common between poultry litter and -- between poultry waste and other fecal material. 01:40PM
Q Okay. So if I asked you to look at the whole, though, not just the --
A I wasn't finished.
MR. GEORGE: Let him finish.
Q Excuse me. 01:40PM

A It would not surprise me if there were certain species of bacteria that prefer to be in other waste but not in others, but I don't know which ones those are. So I'm telling you my expectations, but that's not something I've gone and looked at. 01:40PM
Q Do you know of any other waste that has a similar chemical and bacterial composition as poultry waste?
MR. GEORGE: Object to form.
A Not that I can -- not that I know of, no. 01:41PM
Q Do you know whether or not the primary means of disposal of poultry litter is by land application?
MR. GEORGE: Object to form.
A I don't know that that's the primary, secondary or otherwise. 01:41PM
Q Wouldn't that be important to your analysis?
MR. GEORGE: Object to form.
A It would not be important to a critical review of a PCA. Again, I was not asked to do the source characterization. To the extent I -- to the extent I could have been asked, it might have been important, but I wasn't. 01:41PM
Q So you weren't asked to do any source characterization analysis? 01:41PM

A Except to the extent to compare the PCA results to the source characterization that Dr. Olsen indicated supported his conclusions.
Q Do you know what the sources of phosphorus are in the IRW? 01:42PM
A No, I don't.
Q Do you know what the sources of bacteria, fecal bacteria are in the IRW?
A No, I don't.
Q Do you know whether or not poultry litter that's land applied is incorporated into the soil or not? 01:42PM
A I don't know if it's just laid down or whether it's tilled into the soil somehow. In terms of how it's applied, I don't know technically how that's accomplished. 01:42PM
Q Do you know how long poultry waste has been applied in the IRW?
A No.
Q Are you aware of any pasture, hay field in the IRW that has not received poultry waste? 01:43PM
MR. GEORGE: Object to form.
A The Fite property is rodeo cattle; right? It was not pasture. Was that your question, pasture or what was the second part? 01:43PM

0143
Q Hay field.
A The only samples I've seen from a cattle field in absence of poultry has been the Fite property, which my understanding was rodeo stock. So the answer to your question would be no. 01:43PM
Q Did you do any evaluation of sources for phosphorus in the IRW at all, review any literature, for example?
A There's literature cited in my report. Was your question specific to IRW? I'm sorry? 01:44PM
Q Yes, yes. Sources of phosphorus in the IRW.
A No.
Q Did you do any evaluation of sources of phosphorus in ambient water, surface waters of the IRW? 01:44PM
A Again, this is a question I thought you asked at first, but one of the papers I cited in my report is Sharpley and Smith, and he addresses -- he addresses phosphorus in surface water sources -- phosphorus sources in surface water. Excuse me. 01:44PM
Q And why did you review that?
A If memory serves -- well, let's not go from memory. If I could turn to my report --
Q Certainly. Can you tell me where you're looking and that will help us, please? 01:45PM
0144
A Yes. After I've -- in my report on Page 62, after I've made the point that the bottom sample trend of Olsen's SW3 scores plot is driven primarily by the concentration of total iron plus total aluminum, I point out that iron and aluminum are 01:45PM generally associated with sediment fraction of natural waters, and adsorption of phosphorus to suspended particulate matter is common, and that phosphate ions taken up from water in alumina clay particles -- are taken up by water -- I'm sorry -- 01:45PM taken up from water by alumina clay particles and freshly precipitated iron aluminum hydroxides, and I cite a source for that, and then the next sentence, as such, particle-bound phosphorus constitutes much of the phosphorus in runoff from cultivated lands, 01:46PM and I cite Sharpley and Smith, and in the Sharpley paper he identify -- he identifies some of these cultivated land sources of phosphorus.
Q So it's your opinion that most of the phosphorus that runs off from land-applied fields 01:46PM where poultry waste has been applied is in the particulate form?
MR. GEORGE: Object to form.
A I'm saying most of the total phosphorus that we measure in the water is bound to particulates. 01:46PM
0145
Whether it is released from the source in the dissolved phase and later adsorbs onto a particle or a sediment grain, I'm not saying that I know if it was originally released as a particulate-bound phosphorus. 01:47PM
Q So it's possible that the phosphorus that's released from a poultry-applied field could have been in its dissolved phase prior to it reaching the ambient stream water?
A I can't discount that. 01:47PM

Q Do you know how many fields are cultivated fields in the IRW?
A No, I don't know that number.
Q Isn't it true that there's very few row crop in the IRW? 01:47PM
MR. GEORGE: Object to form.
A Since I don't know the number, I don't know if that's true or false.
Q Whether -- if the IRW has very few row crops, would your reliance on Mr. Sharpley's paper be 01:47PM somewhat doubtful?
MR. GEORGE: Object to form.
A I'm not sure the extent that the statement that Sharpley and Smith make about particle-bound phosphorus -- I'm not sure the extent to which that 01:48PM

0146

is dependent on row crops.
Q Why would you say that? If you haven't cultivated a field, if you're applying poultry waste to a non-cultivated field, isn't there less opportunity for particle affinity? 01:48PM
MR. GEORGE: Object to form.
A I'm having trouble understanding the question. You're saying --
Q Well, your statement here -- I'm sorry, Doctor, if I'm being unclear, but I'm doing my best. 01:49PM
You state here, as such -- I'm reading from your report, Page 62 -- particle-bound phosphorus constitutes much of the phosphorus from runoff from cultivated land.
A Right. 01:49PM
Q Cultivated land, that would be land that would be tilled; correct?
MR. GEORGE: Object to form.
A Yeah, but at the same time I'm not saying that cultivated land is the only source of particle-bound 01:49PM phosphorus. The point -- this is a sentence within -- within an overall paragraph that's talking about the preferential affinity of total phosphorus to be in the particle-bound phase. Now, this sentence supports that, that it's particle bound in 01:49PM

0147

cultivated lands, but that doesn't mean that that affinity of total phosphorus to be bound to particulate matter is different if the particulate is coming from some source other than cultivated land. 01:49PM
Q Okay.
A Whether it's somebody's boot kicking up a little bit of mud in the bottom, whatever.
Q Did you -- have you done any evaluation of the constituents that run off of land in the IRW where 01:50PM poultry waste has been applied?
MR. GEORGE: Object to form.
A No. I've not been asked to do -- was the question have I done --
Q Any analysis. 01:50PM
A Analysis of runoff from -- did you say cultivated or non-cultivated land or --
Q Poultry-applied lands in the IRW.
A Okay. No, not specifically.
Q Would an analysis of those, the chemical 01:50PM contribution of that runoff be important to your PCA

critique?
MR. GEORGE: Object to form.
A No, I don't think so.
Q Why not? 01:50PM

A Because what the PCA is showing is the basic -- is the affinity of phosphorus, iron and aluminum, which means the affinity of total phosphorus to particles regardless of where they come from. 01:51PM
Q So how does that help you understand whether or not the source of phosphorus -- a source of phosphorus in the IRW is from land-applied poultry waste?
A Well, if I wanted to -- if I was asked to take this and I wanted to look at -- find out what the most likely source of the particulates that have that bound phosphorus, maybe I could go through and identify each individual sample and do what you're suggesting to do, but that doesn't -- that doesn't change the basic conclusion that total phosphorus prefers -- tends to be associated with the particulate phase. I don't need to take that -- I don't need to take that next step to back up a conclusion that total phosphorus tends to be 01:51PM 01:52PM associated with the -- with sediments.
Q But doesn't that tend to help you understand whether or not the phosphorus that you are observing was a source from a poultry land application as opposed to another source? 01:52PM

MR. GEORGE: Object to form.
A Perhaps if I had been asked to take -- to make that -- to take this a few extra steps to that point, then perhaps yes, perhaps no. It's difficult to comment on an analysis that I didn't do and what value it might or might not have. 01:52PM
Q Other than this Sharpley article, did you do any other evaluation of the sources of phosphorus that are found in the surface waters of the IRW?
A Specific sources? 01:53PM
Q Yes.
A No.
Q As, you know, poultry, cattle versus wastewater treatment, for example.
A Okay. No. 01:53PM
Q I'm trying to understand, Doctor. Wouldn't that information be helpful for you in determining whether or not this is a source-driven versus a process-driven system?
MR. GEORGE: Object to form. 01:53PM
A No.
MR. GEORGE: Asked and answered.
Q Why not?
A It is a process -- first order this is a process-driven system because the first order to 01:54PM

trends on the first two principal components are driven by iron and aluminum, which is a surrogate for particulates on one trend and sodium, potassium, the more soluble analytes, on the other trend. So it's an explanation that is much simpler. It's an 01:54PM explanation that doesn't call for making exceptions

to a 1.3 Principal Component 1 threshold or apologizing for exceptions to the rule. It's very consistent with very simple geochemistry, and so the first order control on this system is geochemical process affinity to either sediment or in the dissolved phase. I'm not sure I answered your question, but I'm balking with --
Q I'm not sure you did either. 01:54PM
A I guess the original question, I don't need to go any farther than this to know that it's basic geochemistry that's driving this system. I've convinced myself of that and I hope I've convinced the people that read this report. 01:55PM
Q Well, let me ask you this: If there's not sufficient background quantities of phosphorus in the soils to account for the phosphorus that we're finding in the ambient waters of the IRW, to what would you attribute this phosphorus? 01:55PM
MR. GEORGE: Object to form. 01:55PM

A Well, the premise is there's not sufficient background phosphorus, which you are representing to me. I don't know if that's true or not.
Q Okay. Well, did you evaluate the reference or background levels of phosphorus in the IRW? 01:55PM
A No. That's why I say I don't know whether what you are representing to me is true or not.
Q And you say that's not important to your evaluation?
MR. GEORGE: Object to form. 01:56PM
A I'm saying that it doesn't change my opinion that this is a process-driven principal components first and foremost.
Q Okay.
A Phosphorus, regardless of source or regardless whether, as you suggested perhaps, some background level, total phosphorus will -- has an affinity for the particulate phase, and that's what we're see -- that's what is driving this analysis. 01:56PM
Q Have you -- did you look and see whether or not there's any phosphorus that's being -- or what are the levels of phosphorus that are coming out of wastewater treatment plant effluent? 01:56PM
A Not a number that I recall, but that data is within the dataset. I could look at the wastewater treatment plant effluent samples and see where they were. 01:56PM

Q So if there was high phosphorus levels in the effluent from wastewater treatment plants, would that tend to negate your hypothesis that this is a process-driven system -- 01:57PM
MR. GEORGE: Object to form.
Q -- for the phosphorus?
A Not at all. Once the phosphorus gets out into the stream, regardless of source, whether it's wastewater treatment plant or poultry litter or what have you, the geochemical processes of adsorption and solution are relevant regardless of what the original source of phosphorus was. 01:57PM
Q Do you know whether or not poultry waste is typically applied within a few miles of where it is produced in the poultry houses? 01:57PM

MR. GEORGE: Object to form.
A No, I don't know. I don't know how far it gets transported before it's applied. 01:58PM
Q Do you know when poultry waste is most often land applied; what time of year?
A I believe spring and summer is my recollection.
Q Would you give me a definition of a watershed, please? 01:58PM
A My understanding of a watershed is of an area that's all within a single drainage basin, draining to a single downstream point. I -- that's not a definition that I looked up in a book before I walked in here, but that's -- I think that's a reasonable expression of my understanding. 01:59PM
Q Okay. So if you were trying to determine what land area or what waters contribute to a particular sampling point, you would try to determine which land areas drain into that area where the sampling point is being taken? 01:59PM
A Yes. That's reasonable.
Q Do you know whether or not there's a GIS program that allows one to readily identify a subwatershed to determine what area drains into a particular sampling location? 01:59PM
A Wouldn't surprise me if there was one, but I couldn't give you the name of such a software program. 02:00PM
Q Have you ever done that yourself?
A No.
Q Have you ever been called upon to identify the areas that drain into a stream where a sample is being taken, that is, draw a subwatershed? 02:00PM
A I've worked on many stream and river environmental projects where part and parcel of that was determining the direction of flow and what -- where things were coming from. In terms of defining that in terms of the full subwatershed all the way upland onto the divide between that and the next watershed, no. 02:00PM
Q Well, you understand the general principles?
A Yes, I think so.
Q Okay. What is your understanding of surface runoff? 02:01PM
A Again, it's not something I looked up a definition before walking in here, but I would say surface runoff would be water running on the surface of the ground that was not within a channel or a stream. 02:01PM
Q Okay, and is that typically a natural system created by rainfall?
MR. GEORGE: Object to form.
A I think rainfall certainly could be the cause of that. I'm not sure I would exclude all other possibilities. 02:01PM
Q Well, other precipitation, such as snow and ice?
A Yes. 02:01PM
Q Okay.
A Or leaving your hose on in the front yard.

Q I'm trying to look at that as opposed to natural versus anthropogenic types.
A Okay.
Q What about infiltration; what's your understanding of infiltration?
A That would be water seeping into the interstices of surface soils down to deeper depths.
Q Okay. Would you agree, Dr. Johnson, that when water falls as rain on land surface, that one of the following three processes occurs: It runs off; it infiltrates, or it undergoes evapotransportation (sic)? 02:02PM
MR. GEORGE: Object to form. 02:02PM
A Evapotranspiration.
Q Yes, sir. Evapotranspiration. Thank you.
A That sounds like the three I would come up with off the top of my head.
Q Okay. Do you agree that at least a portion of the rain that falls on the land within the IRW runs off the land and ends up in surface water features, such as streams, rivers and lakes in the IRW? 02:02PM
MR. GEORGE: Object to form.
A Yes. 02:03PM

0156

Q Do you agree at least a portion of the rain that falls on land within the IRW infiltrates?
A Probably, yes.
Q Are you familiar with the geology of the IRW?
A Not intimately. I know there's limestone in there, but if I've -- if I've seen the geologic map, I couldn't converse -- I couldn't tell you where the boundaries are of different units. 02:03PM
Q Do you understand that it's a Karst system?
A That's what limestone means, yeah, it implies. 02:03PM
Q Fractured Karst also?
MR. GEORGE: Object to form.
Q Do you understand that, sir?
A I had not heard that specifically, but being if it is limestone, it being Karst would not be a surprise. 02:03PM
Q Do you know whether or not it has dissolution features in it from the limestone being dissolved?
A Most limestones would exhibit dissolution.
Q Do you know whether or not IRW soils are highly susceptible to runoff? 02:04PM
MR. GEORGE: Object to form.
A No, I don't.
Q You don't know one way or the other?
A I don't know one way or the other -- 02:04PM

0157

Q Do you know whether or not?
A -- or I don't know one way compared to how it would compare to other watersheds.
Q Okay. Do you know whether or not they're highly susceptible to groundwater infiltration? 02:04PM
A Again, as compared to other watersheds, I don't know how it would rank in terms of that susceptibility.
Q Let me ask you this: Would you agree, sir, that runoff water that has interacted with soil where poultry waste has been applied will contain suspended particles from the land-applied poultry waste? 02:04PM

MR. GEORGE: Object to form.
A Could you repeat the question? 02:05PM
(Whereupon, the court reporter read back the previous question.)
MR. GEORGE: Same objection.
A I would expect it to contain suspended particles. The extent to which those are suspended 02:05PM particles of actual poultry waste or the material that makes up the litter or the soil that it was applied on, I don't know.
Q Okay. If there was bacteria in the poultry waste and on the soils, would you expect it also to 02:05PM

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contain bacteria?
MR. GEORGE: Object to form.
A That I definitely don't know because the bacteria data I've seen have been so variable I'm not sure how long bacteria would stay alive and be 02:06PM measurable. So I wouldn't comment about what you would expect to see once the bacteria is in some medium outside of the poultry litter.
Q Would you expect that runoff water, going back to the previous question, would be able to 02:06PM discriminate between particles from the soil versus particles that are in the poultry waste?
MR. GEORGE: Object to form.
Q When it collects suspended particles for runoff? 02:06PM
MR. GEORGE: Same objection.
A I have no idea what to expect. I would think -- the issues that pop to mind immediately is how would you tell the difference between a particle in a water sample that came from the waste as opposed 02:07PM to a particle in a water sample that came from soil that was surrounding it.
Q You wouldn't know how to do such an experiment?
A On an individual particle-by-particle basis, 02:07PM

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I'm not sure how that would be done.
Q Would you assume that if there's poultry waste applied to a field and then it rained that evening, sufficient rain to cause runoff, that some of that runoff would contain particles from the poultry 02:07PM waste?
MR. GEORGE: Object to form.
A Again, I wouldn't discount it, but I don't know. Wouldn't discount the possibility.
Q Would you agree that runoff water that's 02:07PM interacted with soil where there's poultry waste been recently applied would contain dissolved chemicals from the land-applied poultry waste?
MR. GEORGE: Same objection.
A I doubt the water would be the same as 02:08PM distilled deionized water. There would be dissolved chemicals in there. The extent to which I could tell you the source of where they came from in such a hypothetical, I can't even begin to respond.
Q Would you expect that water or in water that 02:08PM interacted in such a field and infiltrated would also contain dissolved chemicals?
A I think so. They would definitely contain dissolved chemicals. Where they came from, be it

the material that -- the native material or the 02:08PM
poultry litter, I couldn't tell you.
Q Why don't we take our break now.
VIDEOGRAPHER: We are now off the Record.
The time is 2:08 p.m.
(Following a short recess at 2:08 p.m., 02:08PM
proceedings continued on the Record at 2:25 p.m.)
VIDEOGRAPHER: We are now on the Record.
The time is 2:25 p.m.
Q Dr. Johnson, when you went out to the Illinois
River on your day tour, did you look at any streams? 02:26PM
A Yes. We stopped at several streams.
Q What did you see as far as the composition of
the sediments?
A I am not able to determine the composition of
sediments by eyesight. 02:26PM
Q Well, I'm guess I'm looking at, did you see a
lot of fine grade material?
A I don't recall. I mean, what hits your eye
when you look at a stream or river is the water on
the top, not the sediment on the bottom. I did not 02:26PM
wade out into any of the rivers, did not -- in order
-- certainly did not determine whether I thought it
was a fine grain bottom or a coarse grain bottom.
Q Well, if the rivers and streams of the IRW are
characterized by this cherty soils -- 02:26PM

A I'm sorry?
Q Characterized by cherty-type soils?
A Oh, cherty soils.
Q Yeah, and do not contain a lot of fine-grained
materials, wouldn't that have an effect on your 02:27PM
dissolved versus particulate analysis of the PCA?
MR. GEORGE: Object to form.
A Are you representing that the fine-grained
material is chert?
Q I'm representing that there's very little fine 02:27PM
grain material in the sediments of the IRW.
MR. GEORGE: Object to form.
Q I guess I'm asking you this question, though:
Would the fact that there's very little -- assume
there's very little fine grain material in the 02:27PM
sediments of the IRW streams, would that have an
impact on your process-based analysis?
MR. GEORGE: Object to form.
A Well, I assume that the fine-grained material,
if it's as you say, not abundant, it's also not 02:27PM
zero. There are fine-grained materials in there.
There are probably fine-grained materials in the
stream water to some extent, at least to an extent
within the surface water, and to the extent that
phosphorus prefers to be bound to particulate 02:28PM

material, what fine-grained material is there will
be preferentially wherever it be found, so --
Q So the --
MR. GEORGE: Hang on. Let him finish,
please. 02:28PM
Q I thought you were.
A I am. Go ahead.
MR. GEORGE: My apologies.
Q Would the relative lack of fine-grained

materials have an effect on how much of the phosphorus is adsorbed to particulates? 02:28PM

MR. GEORGE: Object to form.

A Again, you are representing that there's a lack of fine-grained material in the water?

Q Well, did you do an investigation of the sediment, fine-grained materials in this watershed? 02:29PM

A I haven't seen grain size analyses from riverbeds if that's what you're asking.

Q And you did no investigation yourself?

A No, did not. It was not part of my tasks. 02:29PM

Q Did you look at the dissolved versus total concentration for phosphorus in the surface waters of the IRW?

A There are two sets of bar graphs in the back of my report that show the concentration of total 02:29PM

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and dissolved phosphorus, among other constituents, in samples along the two trends that we discussed earlier today.

Q Okay. That's not answering my question.

A Well -- 02:29PM

Q I'm asking whether you looked at dissolved versus total concentration for phosphorus in the rivers and the streams.

MR. GEORGE: Object to form, asked and answered. 02:30PM

A I think I did answer your question because those bar graphs have both total and dissolved forms of phosphorus chemical compositions.

Q How many samples are represented by those bar graphs? 02:30PM

A On each of bar graphs, there are I believe -- let's count them. There are five.

Q Okay, and how many samples were there in the PCA analysis performed by Dr. Olsen?

A There were 573. 02:30PM

Q So did you evaluate the total versus dissolved concentrations among all 573 samples that were evaluated by Dr. Olsen in his PCA?

A Once I determined that the bottom trend of his PCA graph -- 02:30PM

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Q You can answer yes or no, sir. You can answer yes or no.

A Yes.

Q You did? You did do that evaluation?

A Would you like me to -- 02:30PM

Q Sure.

A Okay. The samples along the bottom trend of the PCA graph I determined were primarily a function of increase in concentration of iron and aluminum, total iron and total aluminum, and also phosphorus. 02:31PM

The PC scores plot that follows that graph is a --

Q What -- where's the bar graph you are referring to in your report?

A Okay. The bar graph I'm referring to is on Page 63. Each bar graph on this figure has a red number labeled one, two, three, four, five. If you flip to the page before that, you can see the locations of those five samples plotted on the PCA scores plot. 02:31PM

Q Let me ask you a question. How many of these 02:31PM

five samples are from rivers or streams?
A Two of the five, if my -- if my reading of the sample nomenclature is correct.
Q So you're representing to the court and the jury that you believe by reviewing two samples of 02:32PM

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the rivers and streams of the IRW for total versus dissolved phosphorus, that you've done an evaluation of that?
MR. GEORGE: Object to form.
A If I could be allowed to finish my response before you had the other question, I think I can answer that. 02:32PM
Q Okay.
A The bottom trend samples one through five, their bar graphs are shown on the next -- on -- the bar graphs are shown on Page 63. I have the red or pink shade highlighting on aluminum, on total aluminum, total iron and total phosphorus, and I observed that those three analytes increase as you move -- as you move across that lower trend of the PCA graph. 02:32PM
Following that on the next graph, I have the same PCA scores plot, with the exception being the symbols are color coded by the concentration of total iron plus total aluminum, and you can see there the hotter colors. The oranges, the reds and browns are -- tend to be out along towards the right end of that bottom trend of the PCA graph. 02:33PM
Q Where's your phosphorus analysis in Figure 4-7? 02:33PM

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A I'm making the inference that phosphorus increases as a function of iron plus aluminum on the previous page. Had I -- if you can look on bar graphs on Figure 4-6, the reason I have subfigures there, you can see in the first square of each of those bar graphs, arsenic, barium, copper, manganese -- let me finish, please. The first set of bar graphs are trace elements, and phosphorus relative to its concentration to iron and aluminum is only a fraction of iron and aluminum. 02:33PM
So if you go to the next set of bar graphs, those are the major elements, aluminum, calcium, chloride, iron. When you -- since phosphorus is much lower in concentration, color coding those symbols on the next figure as a function of iron plus aluminum plus phosphorus is not -- would not be that much different from -- I'm sorry, color coding those symbols as a function of iron plus aluminum is not much different from color coding those symbols as a function of iron plus aluminum plus phosphorus because phosphorus is a much lower concentration, but I made the inference that phosphorus is a function of iron plus aluminum and then -- 02:34PM
Q Based on these five samples?
A Based on those five samples, and then made 02:35PM

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the -- by plotting iron plus aluminum, can see for all 573 samples that the general trend is increasing iron and aluminum to the right along that bottom trend of the PCA graph.
Q Okay. Well, looking back on Figure 4-6, 02:35PM

except for Sample No. 2, which is also an edge of field, couldn't you also explain this trend analysis of phosphorus being related higher to aluminum as just being closer to the source of the original release, that is, the edge of field samples are higher than the stream samples? 02:35PM

MR. GEORGE: Object to form.

A Could you repeat the question?

(Whereupon, the court reporter read back the previous question.) 02:36PM

A I would have trouble making that conclusion unless you gave me reason to believe that those edge of fields were the only source of iron and aluminum, and I know that's not true.

Q What other sources of iron and aluminum would you expect to find in the streams? 02:36PM

A Naturally occurring sediment from any source, whether it's from edge of field or --

Q Did you look at the reference concentrations of iron and aluminum in the surface water samples in the IRW? 02:36PM

MR. GEORGE: Object to form.

A Did I look at iron and aluminum in the surface water samples?

Q The reference values for iron and aluminum. 02:37PM

MR. GEORGE: Same objection.

A My understanding is the reference value -- the reference samples were outside the IRW.

Q Okay.

A Did I misunderstand the question? 02:37PM

Q Well, there's some inside and outside reference samples, but did you evaluate the concentration levels for reference -- of reference samples for iron and aluminum?

MR. GEORGE: Same objection. 02:37PM

A Not specifically. I can't tell you what those concentrations were.

Q Did you look at dissolved versus total concentrations of organic carbon in IRW streams?

A I looked at organic carbon in these bar graphs. I did not use that then to plot organic carbon or plot the symbols on the scores plot as a function of organic carbon. 02:37PM

Q And you didn't look at all 500 -- comparison of all 573 samples used in the PCA analysis, did you? 02:38PM

A Not that I recall.

Q What about same question for potassium; did you look at dissolved versus total concentration for potassium found in IRW streams and rivers? 02:38PM

A Yes. We can walk through the rationale, but potassium was one of the dissolved -- the preferential dissolved phase analytes that were -- that followed a similar logic where I showed a trend of five bar graphs, showed they increased along the left trend as you move up on the scores plot, and potassium is one of the analytes that increases as you move up that left trend, and the figure that follows that, Figure 4-10 on Page 67, shows -- shows every sample in SW3, with the exception of samples where they were missing data for one of these four 02:38PM 02:39PM

analytes plotted with a color symbol as a function of the four identified highly soluble analytes, sodium, potassium, chloride and sulfate. So potassium was one of them, and also I'd like to -- 02:39PM

Q Well, if there's --

MR. GEORGE: Hang on.

Q -- something else you want to ask about this, your counsel can ask you on cross examination.

MR. GEORGE: He's not asking a question. 02:39PM

He's answering your question. If he's not through, the witness has a right to complete his answer.

Q Do you feel like you answered my question or you want to --

A I answered that question. I was -- there was some additional -- 02:39PM

Q That's good.

A There was some things I thought about for the TOC question, and if you would like me to elaborate, I would. If you'd like to move on and ask another question, that would be fine. 02:39PM

Q I think given the time -- we're going kind of slow here. If it's important, you can ask your counsel to ask you that question.

A I'll ask him during the break. 02:40PM

Q Did you review all 473 samples --

A 573.

Q Excuse me, 573 samples for dissolved versus total concentration of potassium?

A Yes. 02:40PM

Q Just in this score plot here?

A In this scores plot.

Q Okay. What about for sodium?

A It's all in the same scores plot.

Q And copper? 02:40PM

A Copper was extremely poorly fit by a two principal component model. So in general I was evaluating the analytes that actually were well served by two principal components. Copper didn't fall in that category. 02:40PM

Q So the answer is no?

A The answer is no.

Q I've handed you what's been marked as Exhibit 6 to your deposition. Doctor, have you ever reviewed this paper? 02:41PM

A Not that I recall.

Q Would you look at the first paragraph under the abstract and read that to the bottom of the page where it starts poultry litter and ends manure.

A Poultry litter -- I'm sorry, you asked me to read it? 02:41PM

Q Yes, sir.

A Poultry litter often contains fairly high concentrations of heavy metals. Would you like me to read the citations? 02:41PM

Q No. You can skip those.

A Three citations or two citations, excuse me. Tufft and Nockels, 1991, that arsenic, cobalt, copper, iron, manganese, selenium and zinc are added to poultry diets to prevent diseases, improve weight 02:41PM

gains and feed conversion, and increase egg

production. Most of the metals added passed directly through the bird, which leads to elevated levels in the manure.
Q Do you agree or disagree with that statement? 02:41PM
MR. GEORGE: Object to form.
A I don't know who P. A. Moore is, but I have no reason to believe he would publish something that is false.
Q Are you not familiar with either Drs. Moore or 02:42PM Daniel that are authors of this report or Edwards?
A I don't recall ever meeting them or interacting with them.
Q Do you see they were at this time part of the University of Arkansas? 02:42PM
A Yes, I do. This is 1998.
Q Yes, sir.
A Okay. So ten years ago they were at Arkansas.
Q Yes, sir. Would you look at the second column on the first page, the second paragraph, the second 02:42PM sentence where it starts several workers, would you read two sentences down, please?
A Yes. Several workers -- several workers have shown that soils receiving applications of poultry litter for many years have high concentrations of 02:43PM

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arsenic, copper and zinc, particularly near the soil surface.
Q Would you read the next sentence, please?
A These studies indicate a potential for non-point source metal pollution from fields 02:43PM fertilized with poultry litter.
Q Would you agree or disagree with that statement?
MR. GEORGE: Object to form.
A Same answer as before. I don't know these 02:43PM authors. I've no reason to believe they would --
Q Did any of your work --
A Publish something --
Q -- either corroborate or critique those statements? 02:43PM
A If I could take a minute to check something in my report before I answer that.
Q Yes.
A Would you reread the question, please?
(Whereupon, the court reporter read back the previous question.)
A My work rendered these statements irrelevant to the PCA.
Q And why is that, sir?
A Because a two principal component model does 02:44PM

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not accurately reproduce the concentrations of arsenic, copper or zinc, so the degree to which these are tracers for poultry litter is irrelevant to the PCA with only two principal components.
Q Okay. Can you go down to the bottom sentence 02:44PM of that paragraph where it starts we found, would you read that, please?
A Oh, it's not marked in highlighter? Is this the last sentence?
Q It says we found copper and zinc concentrations.
A We found copper and zinc concentrations in

runoff water as high as 0.7 and 0.1 milligrams per litter, indicating a potential problem.
Q Okay. Would you agree or disagree with that statement? 02:45PM
MR. GEORGE: Object to form.
A I have no reason to disagree with it.
Q Would you go to the bottom of that column and the paragraph that begins the majority; would you read that, please? 02:45PM
A Although it is uncertain if metal runoff is a major problem with the use of animal manures, high P concentrations have been documented in runoff water from pastures fertilized with low to moderate 02:45PM

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amounts of poultry manure, causing concerns over the utilization of this valuable resource in areas of the USA where poultry production is high, and then two citations.
Q Continue. 02:46PM
A Phosphorus is normally the limiting element for eutrophication in freshwater bodies, such as rivers, lakes and reservoirs. Should I continue on to the next page?
Q Yes. 02:46PM
A The majority, 80 to 90 percent, of the P in runoff from fields fertilized with poultry litter is dissolved P, which is the form most readily available to algae.
Q Would you agree or disagree with the last statement you read there that says the majority, 80 to 90 percent, of P in runoff water from fields fertilized with poultry litter is dissolved P, which is the form most readily available to algae? 02:46PM
MR. GEORGE: Object to form.
A I don't know. I don't -- I have no reason to disagree with these guys.
Q Do you have any understanding of what the -- did you do any study of what the most common form of P is that is running off from poultry-litter applied 02:46PM

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fields, whether it's dissolved or total or particulate P?
MR. GEORGE: Object to form, asked and answered.
A No. 02:47PM
Q If there was particulates in poultry waste, wouldn't that prevent the loss that's in poultry waste and on land-applied fields for running off in a dissolved phase?
MR. GEORGE: Object to form. 02:47PM
A There was a key word in there that I missed. Could you please reread that, please?
COURT REPORTER: And I think I misunderstood it as well.
(Whereupon, the court reporter read back the previous question.)
Q Wouldn't that prohibit?
A I don't know the extent to which that would prohibit it or not. I don't know. That's not my area of expertise. 02:48PM
Q In your process analysis in order to confirm your analysis of the PCA, wouldn't it be important to have an understanding of what materials are

running off from poultry waste in a dissolved versus a particulate phase and whether or not there's particulates in the environment to which the dissolved phase constituents could attach? 02:48PM

MR. GEORGE: Object to form.

A I'm not sure if it would or wouldn't because my understanding is they can partition between phases once they get into the ambient environment. 02:48PM

Q But if there isn't any particulate to partition to, wouldn't that affect your analysis?

MR. GEORGE: Object to form.

A Again, you're representing there are no particulates in the stream water and if that is true, then I suppose that's something to consider. I don't -- I doubt the streams here are void of particulate matter. 02:48PM

Q Wouldn't the relative availability of particulates in relationship to the amount of dissolved constituents or running off of poultry land-applied fields have an important place in your evaluation? 02:49PM

MR. GEORGE: Object to form. 02:49PM

A I don't know if I would characterize it as important or not.

Q Can we look to Page 94, sir, of the same article?

A Oh. I'm sorry. 02:49PM

Q Would you look at the second column on Page 94 of this article by Moore, which is Exhibit 6. In the second column, the bottom paragraph where it says soluble copper?

A Uh-huh. 02:50PM

Q Would you read that first sentence, please?

A Soluble copper concentrations in runoff water of the unfertilized control plots average 0.10 milligrams of copper per liter.

Q I'm sorry. I may have directed you to the wrong location. You're reading the next area highlighted, aren't you? 02:50PM

A I'm sorry.

Q That's all right.

A I was reading right there. Is that wrong? 02:50PM

Q No. You can -- go right ahead, go right ahead. That's in the first column. Go ahead.

MR. GEORGE: Are we going to read the whole column?

MR. PAGE: No. We're going to go down to where I marked on this sheet. 02:50PM

MR. GEORGE: Yeah, let's do that.

A Soluble copper concentrations in the runoff water of unfertilized control plots average 0.010 milligrams of copper per liter for the first runoff event and 0.014 milligrams of copper per liter for the second event or seven days later or 7D later. I assume that means days, and then he points to Figure 1. 02:51PM

Q Continue. 02:51PM

A These values are near the average of that for natural waters in the USA, citing Manahan, 1991. The amount of soluble copper in the runoff water

increased linearly with litter application rate regardless of the litter type but was significantly higher from normal litter than alum-treated litter, Figure 1, Tables 2 and 3. 02:51PM

Q Okay, and one more sentence.

A At the highest litter application rate, the average soluble copper concentration in the runoff water from untreated litter was 93 times higher than the control, paren, 93 milligrams of copper per liter. 02:51PM

Q Assuming that finding is true, would that analysis have any impact on your PCA evaluation? 02:52PM

MR. GEORGE: Object to form.

A I'm struggling with the entire line of questioning because I'm asked to review papers quite a bit as part of my job, and I have never gone and read a single half of a paragraph out of context. 02:52PM

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If I was given this paper to review, I would take -- well, I don't know -- but I would take an amount of time well in excess of the five minutes we spent looking at it here to understand the context of the study, et cetera. As such, I have no reason to 02:53PM believe that this author would write something, and I have no reason to doubt what he would say, but I'm -- I hesitate to read an excerpt and tell you whether or not I agree with this study.

Q Okay. Let me ask you one more question on this, and I understand you haven't had a chance to study it, and if you want to take it home tonight and look at it and add any comments, that would be fine, but in the second column -- 02:53PM

A Okay.

Q -- on the same page, the bottom paragraph where it says soluble copper concentrations --

A Uh-huh.

Q -- would you read that sentence, please?

A Soluble copper concentrations in the runoff were highly correlated with soluble organic carbon levels, which supports the findings of del Castilho, 1993, who showed that copper concentrations in soil solutions were more affected by SOC than other soil parameters. 02:53PM

0181

Q Now, assuming that finding is correct, would that influence your analysis of the salty versus particulate PCA evaluation in your report?

MR. GEORGE: Object to form.

A Not in the context of the PCA because copper was an extremely poor fit. If copper is going to be accounted for by this principal components analysis, you need more than two principal components. With respect to whatever this paper purports to tell about copper sources, it is not reflected in the principal components analysis and cannot be evaluated in that context. 02:54PM

Q Would you turn to Page 13 of your report, sir.

A Page 13?

Q Yes, Figure 2-2. Isn't it true that in Dr. Olsen's PCA analysis total copper was highly correlated with this PC1? 02:54PM

A Total copper correlation looks to be on the order of .8 something.

Q And would you consider it, given where it is in the loadings factors, highly correlated with PC1? 02:55PM
A That's the highest positive coefficient, yes.
Q Thank you. Going back to some of our earlier discussions this morning, Dr. Johnson, would you agree that PCA can be used to identify sources of 02:55PM

0182

contamination?
A It can be, but there's no guarantee that it will.
Q Okay. So you recognize it has been used in the past to identify sources? 02:56PM
A Yes, it has.
Q Okay. Do you believe it could be effective in identifying sources in the IRW?
A I state this in my report. I don't believe it could be unless -- especially if you're interested 02:56PM in phosphorus in bacteria, I don't think it's possible without going back and getting a consistent and complete data.
Q I think I've covered this. I want to make sure. Do you know how many different sources of 02:56PM nutrients there are in the IRW?
MR. GEORGE: Object to form, asked and answered.
Q Sources in water in contamination?
A Sources of -- 02:56PM
Q Nutrients.
A No, I don't.
Q How about for metals?
MR. GEORGE: Same objection.
A Antiprogenic metals? 02:56PM

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Q Yes, sir.
A Well, it doesn't matter. I don't know.
Q Salts, same question?
A Yes, same answer.
Q And bacteria? 02:57PM
A Correct.
Q And I do take it you're not -- you don't have an understanding of which among potential sources would be the largest sources?
A I don't have an understanding because I 02:57PM haven't seen data that would allow me to get to such an understanding.
Q Would mass balance information allow you to have an understanding?
MR. GEORGE: Object to form. 02:57PM
A It may or may not. That's not what I was asked to look at.
Q Can we turn to Page 12 of your report, please?
A Okay.
Q The second paragraph where it starts there 02:58PM are, do you see that, sir?
A Yes.
Q Would you read that sentence for the Record, please?
A There are serious flaws in the logic that led 02:58PM

0184

to these conclusions. Olsen justifies his interpretation with a poorly reasoned apples-to-oranges comparison of loadings presented in abstract units of the PCA, log-transformed

correlation coefficients to chemical data and units of concentration. 02:59PM

Q Could you explain for us what you mean by that statement?

A The loadings graphs that he shows -- in fact, we just looked at them. You had me turn to that page. It has been plotted -- do you recall the page we had that on? Oh, it's on the very next page. 02:59PM

Q Table 2-2, yeah. It's on Page 13.

A Yeah. The loadings, as your question indicated, is a function of the correlation coefficient between the principal component and these individual analytes. So the units there are units of a correlation coefficient, which vary from zero to one, so essentially unitness. The chemical compositions that he was comparing these bar graphs to was a table -- let me back up to the text that precedes that paragraph. So he's comparing to presume poultry waste impacted water, and I think by that, he was looking at his synthetic poultry leachate samples. I'll have to go back and see if 02:59PM 03:00PM

0185

there were others. So he's making a comparison of a loadings bar graph where the units are basically a correlation coefficient to a chemical composition in units of milligrams per litter, and in the case of bacteria, organisms per, I believe, it was hundreds milliliters or something like that. So that's what I mean by an apples-to-oranges comparison. They're different units. 03:00PM

Q Different units, but do you think it's fair, though, to compare your loadings, such as found on Figure 2-2, to what you know about the chemical composition of a source that you're investigating? 03:01PM

MR. GEORGE: Object to form.

A I think it's not an unreasonable place to start, but because the units are different -- the other thing when I look at these, and I alluded to this in an earlier response, I want to see -- you were asking about what the correlation coefficient or the height of the bar for total copper was for PC1, and eyeballing it, it looks on the order of .8 or so. So it sounds like an impressive number, but then you go to the goodness-of-fit scatter plots that I showed and you see that copper has a very poor fit for this model. So when I look at that correlation coefficient or the loading number for 03:01PM 03:02PM

0186

copper, I don't put a lot of faith in it because I know that that particular analyte is not well served by only a two principal component model, so --

Q I'm going to move to strike as non-responsive.

MR. PAGE: Could you read back my question again?

MR. ELROD: Wait a minute, wait a minute. Let him finish before you cut him off. I mean, he was right in the middle of a sentence, David.

MR. PAGE: Well -- 03:02PM

MR. ELROD: I mean, you can object but let him finish the sentence.

A Let her read it back. I can add to it when we finish.

(Whereupon, the court reporter read 03:03PM

back the previous question.)
A Could you read the first sentence of my response?
(Whereupon, the court reporter read back an excerpt of the previous answer at Page 185, Lines 14-15.)
A It's not an unreasonable place to start because it is a correlation coefficient. It does provide you some information. The rest of the entire statement that I'm afraid you found not 03:03PM

0187

relevant I think is very relevant because there are problems with equating a loadings in those units and where some of the analytes are not well fit by the model and interpreting it as you would a chemical composition bar graph. So my response -- I hope 03:03PM this is responsive. My response is, it's not a bad place to start, but there's a lot more to it than that.
Q Okay. That would be one of the investigations, though, you in fact yourself have 03:03PM employed to do a source investigation; correct?
A It's one of the methods I used to evaluate -- to evaluate what chemical processes or sources are driving the principal components analysis.
Q And you've seen the other investigators and 03:04PM published literature employ the same methodology, have you not?
MR. GEORGE: Object to form.
A I can honestly say that it has been since literature in the '70s -- I'm not saying it doesn't 03:04PM exist, but I haven't seen somebody take a loadings bar graph and try to interpret it as a chemical composition in a long, long time. There are the issues we just discussed. There is also the issue as basically this is representative of an abstract 03:04PM

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orthogonal axis in space, not the chemical composition of any actual true entity.
So while it would not discount the possibility that some poor misguided soul was out there still publishing a PCA paper that has this type of 03:04PM comparison of a loadings bar graph to a chemical composition, I haven't seen it very often.
Q But you have seen it in published literature, have you not?
MR. GEORGE: Object to form. 03:05PM
A The only thing that I can think of is some micropaleontology publications back from like 1971 where they were comparing Varimax factor bar graphs to -- which are orthogonal axes, to assemblages of planktonic forams. 03:05PM
Q Would you turn to Page 87 of your report?
MR. GEORGE: You don't want to follow up on that, the planktonic forams?
MR. PAGE: I'm going to allow you to do that. I'm not doing paleontology this week. 03:05PM
Q Could you describe for us Figure A-3 in your report?
A Figure A-3 is a figure that was taken from a book chapter I did on principal components analysis, and I used it as an example of a -- I prefaced it 03:06PM

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with an example of a PCB system where there were three PCB sources that were clustered, and when I say clustered, I mean that every sample could be considered the result of one and only one source.

This example that you're asking about followed it and was provided as an example of a dataset where we had mixtures or gradational data where an individual sample cannot be considered to come from one and only one source. 03:06PM

Q Okay. So you mention here in the caption for Figure A-3, it says the three PC source scores plot for three sources? 03:06PM

A Yes.

Q Mixed PCB data?

A Correct. 03:06PM

Q So this is intended to illustrate a scores plot where you've identified three sources?

A Yes.

Q Okay. Is it fair to say, Doctor, that the corners of this exhibit represent the pure forms or end members that we could term as sources and the points in the middle represent various mixtures of these three sources? 03:07PM

A That's correct.

Q Let me hand you what's been marked as Exhibit No. 7. 03:07PM

MR. GEORGE: David, before we get into questions about this, can we have a representation on the Record as to the source of this document?

MR. PAGE: This was in Dr. Olsen's recent errata where he corrected his SW3 scores plot based on the log transformation as identified in Dr. Cowan and Dr. Johnson's report. 03:08PM

MR. GEORGE: For the Record, do you have a date of that errata? I don't recall it.

MR. PAGE: I think it was in January, a couple of weeks ago. 03:08PM

MR. GEORGE: After Dr. Johnson issued his report?

MR. PAGE: That's correct. 03:08PM

Q Have you seen Dr. Olsen's errata, Dr. Johnson?

A No, I have not.

Q Okay. This is the scores plot after the log transformation after the PCA run was performed.

A I'm sorry. So this is SW3 -- 03:09PM

Q Uh-huh.

A -- and the differences between this and what's in his May report is that now he's undone the log transform?

Q Yes, which was one of the criticisms that I think you and Dr. Cowan mention in your report. 03:09PM

A Everything else is as it was?

Q Is the same, yes, sir. That is my representation to you, sir.

MR. GEORGE: David, one thing for the Record, and certainly you ask whatever questions you feel you need to for Dr. Johnson, but I want to make sure the Record reflects that the defendants object to this line of questioning to the extent it is an attempt to get in opinions that are untimely, which the plaintiffs have neither sought nor obtained 03:09PM

leave from the court to submit.
MS. COLLINS: Also for the Record, the date of this errata was February 10, 2009.
MR. PAGE: Time flies. Thank you. 03:09PM
MR. McDANIEL: I'll also add to the objection. To the extent he's asking Dr. Johnson to formulate new opinions today that aren't expressed in his report based on late-produced information, I, too, object on all questions regarding this. 03:10PM
MR. PAGE: Any other objections people would like to make?
MR. ELROD: No, but I have a question. If we look in -- well, this -- the previous iteration of this appears in the Johnson report somewhere that 03:10PM

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we can sit here and compare it to?
A Huh-uh.
MR. ELROD: It does not?
MR. PAGE: It's Dr. Olsen's report in Section 6, Figure 6.11-18D. 03:10PM
MR. ELROD: Okay. I just didn't bring a copy of Olsen's report.
Q Dr. Johnson, I've placed a pen in front of you. Would you be so kind as to circle the majority of the edge of field samples that are found on 03:10PM Exhibit 7?
A The majority?
Q Well, the bulk of them, the location where the bulk of them are found.
A Which symbol is edge of field? 03:11PM
Q I believe it's on the far left. It's a diamond.
A Could I have a few minutes to peruse this? It might be a good time to take a break. I'll be glad to -- I've never seen this figure before, and I'm 03:11PM trying on the fly to figure out the symbols.
Q Okay. We'll take a break now. That's a fair request.
VIDEOGRAPHER: We are now off the Record. The time is 3:11 p.m. 03:11PM

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(Following a short recess at 3:11 p.m., proceedings continued on the Record at 3:20 p.m.)
VIDEOGRAPHER: We are now on the Record. The time is 3:20 p.m.
Q Dr. Johnson, before the break I asked if you 03:21PM could circle the edge of field samples or at least the bulk of them. Could you do that for me, please, sir?
A Okay. So this is the blue triangles then; right? 03:21PM
Q I think they're diamonds.
A Oh, diamonds, correct. I saw another one buried. Here it is.
Q Now, would you do the same for the reference samples and those are illustrated by the 03:21PM reference -- they're green triangles.
A Green triangles. So is this all of them, one, two, three, four, five -- I see six.
Q Yes.
A (Witness complied). 03:22PM
Q Would you also do that for the wastewater treatment plant samples?

A And there are still four?
Q I believe three.
A So Lincoln is no longer considered a wastewater treatment plant sample; is that the one that's left out?
Q There's three on the report here. Lincoln was a stream one also, was it not, Dr. Johnson?
A Yes, but --
Q These are the pure wastewater treatment plant effluents.
MR. GEORGE: Object to form.
Q Do you see three separate groups of patterns on this report as you circled?
A I've drawn three circles here.
Q Do they overlap?
A No.
Q Okay. So is it fair to say there's three separate groupings on this Exhibit 7?
MR. GEORGE: Object to form.
A Within the three context of the three groups you asked me to circle, there's no overlap between those three. There's plenty of overlap between -- with the other samples.
Q Well, the samples that are in the middle, would they not be characterized as mixtures between these three --
MR. GEORGE: Object to form.
Q -- groups that you've circled?
A No, not necessarily.
Q It's a possible interpretation, is it not?
MR. GEORGE: Object to form.
A There's a major difference between -- I think what you're asking me to verify is that each of these groups that I've drawn a circle around, given the question you prefaced it with, is an end member, and so that all the samples in between are mixtures of these end members?
Q Yes, sir, that is the question.
A Okay. There's a fundamental difference between what I see on this graph and what I see on the graph or the figure you showed me from my book chapter.
Q You don't see the resemblance between the two?
A I see the end member locations on that graph as located at a single point in space with -- and here if you're telling me that this -- with my pen I'm highlighting the area that is -- where I drew the boundary around the edge of field samples. This is a wide range of chemical compositions that happened to be connected only in that I drew lines that connected the dots around the outside.
Q Well, Doctor, if you accounted for the fact that in your Figure A-3 your end points are pure products locations, correct, pure product for the PC base?
A Yes.
Q And in this case, we would have mixtures of wastes or reference sample. Would that account for the differences that you see?
MR. GEORGE: Object to form.

A No, it would not. The implication of the question is that there is a, quote, edge of field end member and that this group of samples represents one of the source patterns of this supposed mixing system, when in fact this supposed end member pattern is itself -- has a tremendously wide range of variation that it takes -- that ends up taking up a large portion of the space of this PCA file. Contrast that to that, those Aroclor locations that are end members are essentially single points in space that are not -- 03:25PM 03:26PM

Q So it's a single sample is what you're saying?

A No. If you go to the graph -- well, if you go to the previous graph in the book chapter, I actually show a PCA where I have nothing but replicates or nothing by multiple analyses of the same Aroclor, and what you see when you see that -- this group of Aroclor samples that are all the same 03:26PM 03:26PM

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source, they plot in a very tight little group, and so there's consistency in the chemical composition of the end member there. When you look at one Aroclor 1248, compare it with another, compare it with another, compare it with another, you get much more consistent composition of your source pattern than you do here. 03:27PM

Q Okay. Would you expect a similar constituency that you found in your PCB sources with a waste of the type that's poultry waste with multiple chemical constituents? 03:27PM

MR. GEORGE: Object to form.

A I'm sorry, the question is would I expect to see similar what? I'm sorry.

Q Consistency, chemical consistency that you see in the PCB sample with what you find in poultry waste samples. 03:27PM

A You mean true poultry waste or poultry waste leachate or these edge of fields being assumed to be poultry waste? 03:27PM

Q Well, let's look at true poultry waste first.

A In order to answer that question, I would have to take a -- take the true poultry waste samples and see what the range of variability is between them as compared to the range of variability of a handful of 03:28PM

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five, ten, different congeners specific Aroclor patterns.

Q Okay. So what about --

A So I can't answer that question.

Q What about the question on edge of field samples; wouldn't you expect to see more variability on edge of field samples from poultry-applied fields than you would see from a collection of analysis of a single PCB? 03:28PM

MR. GEORGE: Object to form. 03:28PM

A I would expect to see greater range of variation in edge of field samples than I would from a single anything because there is no variation in a single thing.

Q Okay.

A Maybe I misunderstood the question.

Q Okay. Well, let me ask a follow-up question then. Wouldn't you expect the edge of field samples

to have variable concentrations depending on rain intensity, application timing, those factors? 03:29PM
MR. GEORGE: Object to form.
A Yes, and I would also expect to see a range of variability in the suspended sediment concentrations on those samples as well.
Q Would you agree, Dr. Johnson, that the 03:29PM

downstream points from edge of field samples and wastewater treatment plant samples would continue to be influenced by the constituents that are in those two runoffs?
MR. GEORGE: Object to form. 03:29PM
A Would continue to?
Q Yes, sir.
A I guess I'm struggling because the question presumes that some of these samples are being impacted by these sources, and I wonder if you have 03:30PM a -- if you're asking specifically about which samples, and if so, which presumed source you're -- are you making a -- is this a hypothetical?
Q Yes.
A Okay. 03:30PM
Q Let me ask this question for you: Would you agree that downstream points in the IRW would be affected by some degree by edge of field runoff that's upstream from that sampling?
MR. GEORGE: Object to form. 03:30PM
A I think it's more likely that things come from upstream than downstream.
Q So the answer is yes?
A Yes.
Q Did you review Dr. Olsen's analysis of the 03:30PM

leachates from poultry and cattle waste?
A I reviewed the table of the leachate data to the extent that he tried to make a comparison of loadings plots to the leachate. I saw a preliminary PCA that did not appear in his report but was in his 03:31PM produced materials where synthetic leachate from poultry and cattle manure were included with stream water samples.
Q Okay.
A So, yes. 03:31PM
Q Did you see a difference in the constituents between the leachate from cattle waste versus poultry waste?
MR. GEORGE: Object to form.
A I recall from that preliminary PCA that the 03:31PM cattle leachate was located closer to the stream water samples than were the poultry leachate samples.
Q Okay.
A So in that respect, yes, I saw a difference in 03:32PM the composition.
Q Did you compare the chemical compositions with two leachate tests just by looking at different chemical results?
A To the extent that I saw that on the table 03:32PM

that he had with respect to the -- yeah, there's a table in the back of his report that shows that. They were not identical concentrations. I could not

tell you which analytes had the largest or smallest differences. 03:32PM

Q In figure or Exhibit 7, which of the plots, the points on this figure would you identify as stream samples?

MR. GEORGE: Which points have Dr. Olsen identified as a stream sample or does this witness identify as a stream sample? I'm not sure I understand your question. 03:32PM

MR. PAGE: Dr. Olsen.

A He's identified blue triangles as stream base flow. Your question, which categories or how many? I'm sorry. 03:33PM

Q Which ones? Can you identify that for the Record?

A Stream samples. The blue triangles are identified as stream base flow. The red samples are identified as stream high flow. The blue circles are HFS base flow. The reddish brown circles are HFS high flow. 03:33PM

MR. ELROD: Am I only the one person in the room that does not know what HSF means? 03:33PM

0202

Q Do you know what that means?

A My recollection it stands for high flow sample.

MR. ELROD: Okay.

A Or high flow station. I don't recall if I ever saw a completely satisfactory explanation of what an HFS base flow sample is. Okay. Continuing on, the blue crosses are USGS base flow, which I believe would be stream flow samples. The red crosses would be USGS high flow. 03:33PM 03:34PM

Q Do you recall -- do you recall where these cattle synthetic leachates plotted on the PC1 SW3 analysis -- excuse me, on the SW3 analysis?

A Which leachate?

Q The cattle synthetic leachate. 03:34PM

A They were not in SW3. I think I -- if I didn't -- if I didn't, let me clarify. The leachate that I saw was a preliminary PCA that did not appear in Dr. Olsen's report, and I believe it was run sometime in mid April, so it was not SW3. 03:34PM

Q I thought you said you compared it with some stream samples in your previous testimony.

A That preliminary analysis was a PCA that included stream samples and the synthetic leachate samples. 03:35PM

0203

Q I see. Thank you. Would you turn to Page A-30 of your report, sir? At the top paragraph do you see where it -- you mentioned this halfway down, for an interpretation of a PCA to be viable, it must be consistent with other lines of evidence? 03:36PM

A Yes.

Q Do you know whether or not Dr. Olsen considered other lines of evidence when he was doing his PCA evaluation?

A I don't know. These -- it did not appear that he evaluated lines of evidence that I point out following this paragraph. 03:36PM

Q Which was the spatial analysis?

A Yeah.

Q Did you review his report in Section 6 where he discussed the different lines of evidence he considered? 03:36PM
A With respect to the PCA?
Q Yes.
A Yes, I did. My recollection is that the primary line of evidence for validation of the PCA was the spatial analysis in terms of establishing a poultry threshold cutoff of 1.3. 03:36PM
Q I hand you what's been marked as Exhibit 8 and that's Section 6 to Dr. Olsen's report. 03:37PM

A Should I keep this open?
Q I don't think you need to keep it open. Do you recall reading Section 6.2?
A Not specifically.
Q Would you read the first paragraph under 6.2, please? 03:37PM
A The overall evaluation was conducted using multiple evaluations and investigations for multiple lines of evidence. The results of multiple evaluations and investigations were then used to determine overall conclusions concerning the hypotheses. This method of evaluation is called a weight of evidence approach. The evaluation conducted where the lines of evidence include the following. 03:37PM
Q Okay. So is that -- would it be fair to interpret that as Dr. Olsen's setting out the weight or lines of evidence he considered when he did his evaluation?
MR. GEORGE: Object to form. 03:38PM
A Let me read on and see what lines he cites.
Q Okay. Let's read the first one, the first --
A IRW geology and hydrogeology in relation to the fate and transport of potential sources of contamination. 03:38PM

Q Okay. Did you do a similar evaluation; did you do an evaluation of the IRW geology or hydrogeology in relation to fate and transport of --
MR. GEORGE: Object to the form.
Q -- potential sources of contamination when you did your evaluation? 03:38PM
MR. GEORGE: I'm sorry. Asked and answered.
A This goes back to the earlier questions. I was not asked to do this. There were other experts on the team that were doing it. 03:38PM
Q So you did not --
A My focus was on the bullet at the bottom, chemical and bacterial signatures, and relating that back to -- 03:38PM
Q But there are some other -- you've stated that it's important to look at other lines of evidence in doing an interpretation of PCA; correct?
A Uh-huh.
Q And you did not look at the geological and hydrogeological evidence when you did your PCA critique; correct? 03:38PM
MR. GEORGE: Object to form.
A I focused primarily on the lines of evidence within his PCA section that he said he used to 03:39PM

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evaluate the validity of his 1.3 cutoff.
In terms of geology, I mentioned earlier there was some analytes that were not well fit by a two principal component model. One of those was calcium, and I considered the fact that this was a Karst calcium carbonate, and perhaps that to fit calcium, that would explain why you needed to go beyond two principal components. 03:39PM
Q So could I ask a question then?
A Well --
Q Are you saying you did --
MR. GEORGE: Hang on.
Q -- or you did not consider geology and hydrogeology in relation to fate and transport when you did your PCA critique? 03:39PM
MR. GEORGE: Just a moment. He was not finished answering the question that was on the table.
A Well, what I was going to about say was basically in response to that question as well, so we can kill two birds with one stone. I was aware of these other aspects, and the limestone geology. Karst geology of this site is something I was aware of but when it came to evaluating the PCA, I focused primarily on the lines of evidence cited in his PCA 03:40PM

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sections that were -- that he claimed were relevant and evaluated the degree to which I agreed if they were or were not relevant.
Q Is the question to my question, no, you did not? 03:40PM
A I just said that I did. The example being the geology -- I put more focus on issues such that were specifically cited in support of the PCA, but giving you the example of the calcium and the Karst topography, I was not blind to the geology and I was not ignoring it, but that is not where my focus in this evaluation was. 03:40PM
Q So would you -- based on that evaluation of the geology and hydrogeology, would you believe that it is reasonable that land-applied poultry waste would run off the land and into the rivers and streams in the IRW -- 03:41PM
MR. GEORGE: Object to form.
Q -- after rainfall?
MR. GEORGE: Same objection. 03:41PM
A Could you reread the question, please?
(Whereupon, the court reporter read back the previous question.)
A The geology, hydrogeology did not inform that part of my analysis. 03:41PM

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Q Either way?
A Either way.
Q What about infiltration of poultry waste constituents that were land applied; did your analysis inform you whether or not that would be plausible or not? 03:42PM
MS. COLLINS: Object to form.
A Not specifically, no.
Q Do you believe that it would be reasonable to conclude that poultry -- land-applied poultry waste 03:42PM

does run off the fields and does infiltrate into the groundwater under the fields at which it is applied?
MR. GEORGE: Object to form, asked and answered.
A It's a possibility. I was -- that's not part of what I evaluated. 03:42PM
Q Okay. Would you read the second bullet, please?
A The chemical and bacterial composition of contaminant sources. 03:42PM
Q Okay. Did you do any chemical or bacterial composition of the contamination sources in order to evaluate Dr. Olsen's PCA analysis?
A This question was asked earlier. I won't go into all the details, but we discussed the synthetic 03:43PM

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poultry leachate, synthetic cattle leachate experiments to the extent that those are representative of contamination sources. The wastewater treatment plant samples were included within the PCA. 03:43PM
Q So is the answer yes or no?
A Yes.
Q Okay. Is it your opinion, sir, that these chemical analysis of different sources and bacterial analysis sources support Dr. Olsen's analysis of 03:43PM source identification in the IRW?
MR. GEORGE: Object to form.
A Do these chemical compositions support his opinions?
Q Yes. 03:44PM
A No, that's the -- no, I don't.
Q So you don't believe the chemical analysis of poultry waste supports Dr. Olsen's analysis that PC1 represents or is associated with poultry waste?
A No. 03:44PM
Q Okay. Do you believe the chemical analysis of wastewater treatment waste supports Dr. Olsen's analysis that PC2 is associated with wastewater treatment plant waste?
A No, I do not. 03:44PM

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Q Okay. No. 3, potential sources and mass balance of phosphorus, bacteria and other contaminants in the IRW. I think you earlier said you didn't look into that; is that correct?
A I did not. I did not investigate and redo the mass balance analyses. 03:44PM
Q You didn't have any information on that one way or the other?
A I saw -- I think I read the write-up, which is in his report, but I did not go back and redo that analysis in the manner that I did the PCA. 03:45PM
Q Could you read the next bullet, please?
A We're on the fourth one now?
Q Yes.
A The overall pathway sampling approach and chemical bacteria contaminants observed in each environment component. 03:45PM
Q Okay. Did you do that evaluation when you looked at Dr. Olsen's PCA analysis?
MR. GEORGE: Object to form. 03:45PM
A No. I was not asked to do that.

Q Would an evaluation of concentration gradients from the location of the release of the contaminant be important to an evaluation of identification of a source of the contamination? 03:45PM

MR. GEORGE: Object to form.

A Maybe I missed the point of this bullet. Is this bullet about concentration gradients?

Q Yes, sir, it would include that.

A Well, we talked earlier this morning. I did look at concentrations of some analytes, such as phosphorus. So if that's -- if that's lumped into this bullet, then, yes, I did. 03:46PM

Q Did you evaluate concentration gradients in the different environmental components to determine whether PC1 is related to poultry waste land application? 03:46PM

A What are the different environmental components you're talking about, like soil versus water versus -- 03:46PM

Q I'm looking at like edge of field to small streams to larger streams to sediments to lake waters as -- you know, the traveling downhill so to speak of the waters.

A Okay. Can you reread the question? I lost it while I was asking for clarification. 03:46PM

(Whereupon, the court reporter read back the previous question.)

A I was -- I evaluated the concentrations within edge of field versus reference samples versus 03:47PM

others, and I'm aware that the edge of field samples, the total concentrations for metals are higher in those samples, but ultimately I think where your question eventually was going was with regard to interpretation of PC1. 03:47PM

Q Well, did you see any gradients of those metals from the edge of field to streams to the larger ambient waters to the lake?

MR. GEORGE: Object to form.

A What I recall is I do know the edge of field metals concentrations were higher. The degree to which I could talk about the stepdown in concentrations from one to the next on down to the lake, I can't. I don't recall. 03:47PM

Q Is that because you did not do that evaluation? 03:48PM

A Not specifically going from sample to sample like you just indicated.

Q What about for phosphorus; did you do an evaluation for phosphorus of that type? 03:48PM

A No, I did not.

Q How about for bacteria?

A No.

Q Next bullet, would you read that, please, sir? I think it's the fifth bullet from the top. 03:48PM

A Okay. The nature and extent of contamination in the environment throughout the IRW for sediments, including sediment core samples from Lake Tenkiller.

Q Did you do an evaluation of that type when you were doing your PCA analysis? 03:48PM

A Again, my focus was the PCA. There were

others on the defense expert team that were --
Q You can just say no?
A Okay.
Q And save a little time. 03:48PM
A Well, I can but I -- if I'm allowed to elaborate, I would rather to clarify.
Q And so did you consider the core analysis that was in Dr. Fisher's report?
A Only to the extent that the cores were 03:49PM included in one of the principal components analyses that Dr. Olsen indicated were one of his major four, but there was very little discussion and interpretation that wasn't derivative of -- was it
-- did you say Fisher? 03:49PM
Q Dr. Fisher.
A Dr. Fisher.
Q Dr. Fisher's report.
A Okay. So ultimately there were very few
PCA-based conclusions, if any, coming out of the PCA 03:49PM

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run that included the core sediment samples, and so I did not spend a lot of time looking at the -- at that PCA run or the core samples that were included.
Q Do you recall whether or not Dr. Olsen identified the poultry signature in the core samples 03:49PM from the lake?
A I don't believe he discussed that. At least he did not in terms of the PCA. He called back to the -- I believe the analysis of Fisher.
Q Have you ever used PCA to evaluate sources of 03:50PM contamination that are found in core samples?
A Yes.
Q Do you need PCA analysis in order to evaluate source of contamination in core samples?
A Not necessarily. 03:50PM
Q There are other methods to do so?
A Yes, there are.
Q Did you look at the method that Dr. Fisher employed in his report?
MR. GEORGE: Object to form. 03:51PM
A I think I answered that. I looked at Fisher's report. I did not review that part of his analysis in any detail.
Q Do you know whether or not the methodology
employed is one that you've seen be employed by 03:51PM

0215

other environmental investigators?
MR. GEORGE: Object to form.
A I can't remember the details of analysis so I can't comment; I can't answer that question.
Q Would you read the next bullet, please? 03:51PM
A The fate and transport of poultry-related contaminants in the IRW.
Q Did you do any evaluation of the fate and transport of poultry-related contaminants in the IRW to evaluate your PCA analysis? 03:51PM
MR. GEORGE: Object to form.
A Yes.
Q And what -- did you do any modeling work in that regard or review of any modeling work?
A Some people consider PCA modeling. If you do, 03:52PM the answer is yes.
Q Any other modeling?

A No.
Q Did you consider any of the work done by Dr. Engel a fate and transport analysis? 03:52PM
A No, I did not.
Q Did you consider the work that Dr. Fisher did evaluating the chemical relationships in poultry waste in the various medias?
A Sorry. Could you read that back? 03:52PM

(Whereupon, the court reporter read back the previous question.)
Q In that respect, that is the different ratios he evaluated with different waste constituents.
A No. There were others on the team looking at that. 03:52PM
Q So you did not?
A I did not.
Q Would you read the next bullet for me, please, sir? 03:52PM
A We're at the third one from the bottom now?
Q Yes, sir.
A Small basin phosphorus concentrations, relationships to poultry house density.
Q Did you evaluate any work that related poultry house density to the concentration of phosphorus in streams? 03:53PM
A Not specifically. To the extent that phosphorus was part of the PCA and I evaluated in context of poultry house density, yes. 03:53PM
Q That was it?
A That was it.
Q Okay, and what about chemical and bacterial signature of contamination of sources using principal component analysis; you have done that; 03:53PM

that's correct? Oh, I skipped one.
A Okay. I was wondering. I was about to ask if that was by design.
Q No, it wasn't. It was because I skipped it unintentionally. Would you read the next one, please? 03:53PM
A Evaluation of the poultry waste biomarker.
Q Okay. Did you look at anything in Dr. Harwood's report on evaluation of fate and transport of poultry waste based on her biomarker? 03:53PM
A No.
Q Of course, the last bullet is what you did focus on in this analysis; correct?
A Correct.
Q Would consideration of all of these different lines of evidence been important to you in doing your evaluation if you were trying to identify where the signature has validity? 03:54PM
A In terms of what I was charged with, no, and given the fact there were other experts and other people working for the defendants that were addressing those issues, no. 03:54PM
Q So do you feel like you've met yourself in this case I guess the advice you provided here on Page A-30 that says for interpretation of PCA to be 03:54PM

viable, it must be consistent within the lines of evidence?

A Well, yes, I do, and I also think that the other experts that are working for the defendants in this case that were aware of my PCA and are looking at some of these other issues are doing exactly that. 03:55PM

Q But you didn't do it yourself --

A That's correct.

Q -- to evaluate for PCA? 03:55PM

MR. GEORGE: Object to form.

Q Can we turn to Page 70 of your report, please? It's not A-70. It's 70?

A 7-0?

Q 7-0, yes, sir. 03:55PM

A Before we have a fresh question on the table, can we take a break?

Q Absolutely.

A Thank you.

VIDEOGRAPHER: We are now off the Record. 03:56PM
The time is 3:55 p.m.

(Following a short recess at 3:56 p.m., proceedings continued on the Record at 4:09 p.m.)

VIDEOGRAPHER: We are now on the Record.

The time is 4:09 p.m. 04:09PM

Q Dr. Johnson, would you turn to Page 70 of your report, please?

A Yes.

Q Are you there?

A Yes. 04:09PM

Q Would you read for me -- that's where we were, that's right. I forgot. Thank you for reminding me. The second full paragraph where it starts but most importantly, three sentences in there's a sentence that begins Olsen's analysis? 04:09PM

A Olsen's analysis was doomed from the start because he assumed a geochemical system controlled by unchanging ratios of source diagnostic chemicals/bacteria as discussed in section --

Q That's good. I just want to ask you about that first sentence there. 04:09PM

A Okay.

Q Could you explain that sentence for me, please?

A I never -- in his report I never saw him discuss the interpretation of principal components in any context, even hypothetically, other than sources and in particular poultry and wastewater treatment plant. I think it's important that you when you go into a multivariate analysis, that you 04:09PM 04:10PM

keep an open mind that the patterns that are controlling this may be related to source, but they also may be related to processes, such as degradation or -- we discussed this morning very early on some of the multivariate analyses that I've been involved with, and we didn't always get source fingerprints. Sometimes we got source fingerprints; sometimes we got process-related fingerprints, and sometimes we got a little bit of both. 04:10PM

Q Well, can you point to us somewhere in Dr. Olsen's report where he actually states that he focused only on sources when he did his analysis? 04:10PM

A Well, I think when I answered that question

previously, I think the way I stated it is that I couldn't find any evidence that he evaluated it in any context other than source, so --
Q Are all of your evaluations that you did in this case set forth in your report?
A There are -- we discussed this morning there is some of the analyses that are in my produced materials that are not discussed in the report, yes. 04:11PM
Q Isn't it true that your PC analysis with PCBs you make this assumption?
A No.
Q You don't? 04:11PM

A I do not.
Q Isn't it also true that Olsen's PC analysis is based upon the correlation matrix of the logs of the variables?
A You said isn't this also true, and I just said the previous one is not true. 04:12PM
Q Okay.
A Would you repeat the question, please?
Q Is it true that Olsen's PC analysis is based upon the correlation matrix of the logs of the variables that he considers? 04:12PM
A Yes.
Q Okay. Can you explain to me what you mean by unchanging ratios in the statements we were looking at? 04:12PM
A Yes. The -- if you're concluding -- if you're assuming a source model that is conserved in the environment, then you are also assuming that as a group of chemicals are released into the environment, that all of them behave somewhat similarly, so that some do not go into solution or others prefer to adsorb onto particulates. Those processes will change the ratios of chemicals and analytes within the system. I'm not sure I answered your question. Could you reread the question, 04:12PM 04:13PM

please?
(Whereupon, the court reporter read back the previous question.)
A Yes. Okay. These processes that I'm talking about, in this case differential partitioning are going into solution, those alteration processes have the effect of changing the ratios of chemicals in environmental media. It happens with PCBs, and it's happened here. 04:13PM
Q Okay, and is it your belief that Dr. Olsen believes that -- that he did an evaluation of the relationships among the variables that were not constants? 04:13PM
MR. GEORGE: Object to form.
A I'm not sure I understand the question. 04:14PM
Q I'm trying to understand. Are you suggesting that Dr. Olsen believed that the variables were constants when he did his analysis, PCA analysis?
MR. GEORGE: Object to form.
A Whether it was an implicit assumption or an explicit assumption, I can't comment on, but it's at least an implicit assumption if he is never interpreting a principal component in any context other than sources. 04:14PM

Q Isn't it true that Dr. Olsen's PC analysis is based on the correlation matrix of the logs of the variables that he considers? 04:14PM

MR. GEORGE: Object to form, asked and answered.

A I was about to say, is that different from the question you asked? I think the answer is yes, and I think it's the same question you just asked before. 04:15PM

Q I don't know if it's the same question or not. I think it's a different question. 04:15PM

A Could you read it again? I want to make sure it --

COURT REPORTER: The question that's pending?

A The question that's pending. 04:15PM

(Whereupon, the court reporter read back the previous question.)

A Yes, that's true.

Q Okay. In order for this PC analysis to be meaningful, does there need to be a significant linear relationship among the logs of most of the variables of concern? 04:15PM

A There needs -- you're asking me if there needs to be a consistent linear relationship among the logs; is that what you said? 04:16PM

MR. PAGE: Would you restate the question for him, please?

(Whereupon, the court reporter read back the previous question.)

MR. GEORGE: Object to form. 04:16PM

A I'm not sure I understand the question. You mean the fact that you were doing the log transform suggesting that perhaps that makes it non-linear or that the underlying data is non-linear?

Q In relationship to the correlation matrix for the PC analysis. 04:16PM

A I'm sorry. Could you reread the question one more time?

(Whereupon, the court reporter read back the previous question at Page 223, Lines 19-22.)

A I don't know that that's true or not. I've done PCA-based analyses of data that -- where I thought there were non-linear issues, and I was able to get results that were interpretable. Now, the degree to which some of these non-linear considerations might be impacting the calculation, you might want to take that into account, but I -- I'm still not sure I understand the question. 04:17PM

Q When Dr. Olsen did his analysis, did he look for a significant linear relationship among the variables of concern? 04:17PM

A Are you talking about on the normality plots?

Q The PC analysis, PC analysis.

MR. GEORGE: Object to form. 04:18PM

A I'm sorry. I forgot.

Q You can go ahead and answer the question even if I turn and whisper to the guy next to me. Okay?

A Okay. Can you -- yeah. First I need to

remember what the question was.
(Whereupon, the court reporter read back the previous questions and answer at Page 224, Line 1 to Page 225, Line 4.)
A Sorry for wasting your time. There's a much easier answer. I don't know what he looked for. I'm not sure what the question means, but I can't tell you whether or not he looked for that or not. 04:19PM
Q Okay. Is one of your key criticisms of Dr. Olsen's work your belief that he's guilty of reification? 04:19PM
A Yes.
Q Would you explain what you mean by that, please?
A Reification is a term used whereby a -- the actual principal component is assumed to be a source 04:19PM

0226

-- in this context a source fingerprint or in the context of some of the other literature I cited in the appendix, equated with a thing. Olsen's testimony and report has consistently talked about PC1 being chicken waste, PC2 being wastewater 04:19PM
treatment plant.
Q You seriously contend that you believe that Dr. Olsen believes that the PC1 equals poultry waste?
MR. GEORGE: Object to form. 04:20PM
Q Is that what you're saying?
A He's -- I think he's saying that the chemical composition of PC1 is representative of poultry waste.
Q Or associated? 04:20PM
A Or --
Q Associated?
A Associated.
MR. GEORGE: Object to form.
Q With poultry waste? 04:20PM
A Well, that, too.
Q Okay. Do you -- so you believe that you're critical of him for saying that a principal component can be associated or identified with the waste as opposed to being equal to the waste? 04:20PM

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That's what I'm trying to understand. Are you suggesting that Dr. Olsen believes that PC1 equals poultry waste?
MR. GEORGE: Object to form.
A That's -- the way I read his report is that he thinks that PC1, the chemical position, the loading composition of PC1 is poultry waste. Now, associated with, where we're drawing the distinction there, I'm not exactly sure. 04:20PM
Q Well, associated with means that the chemical composition in my mind would be representative of what the chemical composition of poultry waste is. 04:21PM
A So you're saying that the composition of the principal component being similar to the composition of poultry waste constitutes associated with rather than equal? 04:21PM
Q Well, and the correlations among those variables.
MR. GEORGE: Object to form. I'm not sure if that's a question. 04:21PM

A If it is a question, could I have it reread?
MR. GEORGE: It's probably clear it's not a question.
COURT REPORTER: Well, what he said was, well, and the correlations among those variables.

Now, if you'd like me to go back to the previous thing --
A Yeah, please go back to the previous one.
(Whereupon, the court reporter read back the previous question at Page 227, Lines 10-12.)
MR. ELROD: Glenn, you're out of control.
MR. GEORGE: Actually, I think David is just testifying. Now, Glenn is asking questions.
A I'd like to ask you to rephrase the question or repeat it. I'm not trying to dodge it. I just want to understand it before I know what I'm answering. 04:22PM
Q Isn't it typical for PCA investigators to state that they believe that their PC that they identified is associated with a particular source of contamination? 04:23PM
A I would say that when I've done goodness-of-fit analysis of a PCA, I know, for example, that if I'm dealing with a five principal component model, that I need that fifth principal component if I want to accurately account for such and such a chemical, and I may also know that once I do to that fifth principal component and I take this next step to do a receptor model-type of approach 04:23PM

and identify five patterns that are not equivalent to principal components, they are points within principal component space, you may need that fifth dimension, that fifth axis and principal component space to resolve that pattern that you may want to call a source fingerprint or an alteration fingerprint. Where I'm drawing the line is saying that Principal Component 5 equals this source or even implying that the principal component equals this source. 04:24PM
Q Well, Dr. Olsen never said it equaled the source; he referred to it as being identified with.
MR. GEORGE: Object to form.
Q Did he not?
MR. GEORGE: Object to form. 04:24PM
A In his PI deposition testimony, I can't remember a page number, but there were instances where he would say PC1, comma, the chicken signature or something very, very similar to that, and that to me tells me that he -- that he was equating PC1 with the, quote, chicken signature. You label something called PC1 and then either parenthetically or behind a comma clarify what you think that means. 04:24PM
Q And we may just be talking past each other.
MR. GEORGE: Hang you. Let him finish his answer. 04:25PM
A I was almost finished. That to me implies that you are equating one with the other. You are renaming outside of the jargon of PCA into the jargon of sources after a comma what you think this 04:25PM

thing is.
Q Okay. Would you turn to page -- Exhibit 8, Page 6-59, please.
MR. GEORGE: What is Exhibit 8?
A Have I had -- oh. 04:25PM
MR. PAGE: Exhibit 8 is Dr. Olsen's report on PCA.
A What page? I'm sorry.
Q Page 6-59. I assume you've been deposed before, Dr. Johnson, and I imagine you probably are 04:25PM not like most people. You have perfect statements on your questions so you don't have any confusing statements during a deposition ever occur. So what I'd like you to do is look at Page 6-59 under summary observations -- 04:26PM
A Okay.
Q -- where Dr. Olsen describes PC1. Would you read that first sentence, please?
A Because of the spatial analysis and comparisons to waste compositions, PC1 has been 04:26PM

0231

identified as related to poultry contamination.
Q Now, do you believe that Dr. Olsen is saying it equals poultry contamination?
A In that sentence, that is not what he's saying. I'm saying there are other places where he 04:26PM has -- where he has -- where he has gone beyond saying as related.
Q Okay. Would you continue on?
A PC2 has been identified as related to wastewater treatment discharge. 04:26PM
Q Okay. So what you're saying is there's times when Mr. George was examining him and he may have said something different than what's set forth in writing in his report; is that what you are suggesting? 04:27PM
A Yes, but I would also note that this was written after there was an earlier expert who identified the reification issue after that. I believe Huber discussed the reification issue, so I'm quite sure that perhaps there's a bit of backing 04:27PM off of that language, but during the PI, the language of his testimony was that PC1 was the chicken signature, and if we do want to get into semantics as the difference between identified as related to poultry contamination and equal poultry 04:27PM

0232

contamination, okay, I'm -- I --
Q I guess I'm still trying to understand if you think Dr. Olsen believes that PC1 is the same thing as poultry poop you put on the table.
A I would hope that he now doesn't believe that. 04:28PM
Q Do you think at one time he actually believed that?
A Yes, I do, but I'm not a psychologist. I don't know what he actually believed.
Q You think -- 04:28PM
A I think --
Q -- based on his history --
A -- based on the statements that he made, I think there was a time when he used the terms interchangeably. 04:28PM
Q And he believed that the word PC1 was chicken

poop?
MR. GEORGE: Objection, asked and answered --
A Again, I don't know what he believed. 04:28PM
MR. GEORGE: -- fourteen times.
A I'm telling you he used the terms interchangeably.
Q Now, I believe if I've heard your testimony and read your report correctly, you've criticized 04:29PM

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Dr. Olsen for focusing on only two principal components; is that correct?
A Yes.
Q And why is there a problem with that?
A Because some of the chemical analytes that he 04:29PM ultimately concludes are important for the poultry fingerprint are not accurately back calculated by two principal components.
Q And do you know whether or not Dr. Olsen actually considered more than two principal 04:29PM components when he did his initial analysis?
A The goodness-of-fit diagnostics that are within the SysStat program included I believe scree plots and the average Eigenvalue criteria, both of which, I believe, for all four of the primary 04:29PM principal components that he listed indicated more than two.
Q Okay. Do you know whether or not Dr. Olsen reviewed those scree plots and the Eigenvalues when he did his analysis? 04:30PM
A They're included in his report, so I assume that he looked at that.
Q So how can you conclude that he did not consider those when he did his evaluation?
A I have a discussion in my report where I talk 04:30PM

0234

about the paragraphs where he discusses those goodness-of-fit. He acknowledges that the average Eigenvalue criteria and the scree plots indicated four to five principal components, and then there's a bit of text that's the rationale that ultimately 04:30PM gets him to looking at only two principal components. I did not find that rationale convincing.
Q Okay, but you will agree that Dr. Olsen did consider more than two PCs when he did his 04:30PM evaluation?
A He got goodness-of-fit statistics that indicated that there were more than two principal components, but his interpretations ultimately only focused on two. 04:31PM
Q Would you turn to Page A-23 and 24 of your report, please? Is this where you've done your analysis in this regard?
MR. GEORGE: Object to form.
A Which regard? 04:31PM
Q The goodness-of-fit analysis.
MR. GEORGE: Referring to Figure A-6?
MR. PAGE: Yes, Figure A-6.
Q I'm sorry, Dr. Johnson. Would you look at Figure A-6 of Page A-23? 04:32PM

0235

A Yes. That is it, yes.

Q Okay. Is that where you've done a goodness-of-fit analysis to be critical of Dr. Olsen in his selection of PCs?
A I point to that doing the criticism, but I did this before any criticism arose. 04:32PM
Q All right. Would you turn back to Page 4, sir?
A Okay.
Q It's the third bullet. No. 2 in the hole, would you read that, please? 04:32PM
A Data transformations used were not appropriate for this type of analysis.
Q What do you mean by that, sir?
A The main one that was the -- I would have recommended that he do some sort of a sample normalization that would take out the effect of vastly different concentrations. 04:33PM
Q Did he not do that when he did a log transformation and the Z-transformation of the data? 04:33PM
A No, he did not.
Q You don't believe log transformation and Z-transformation does take out the skewness of the concentrations?
A Well, skewness and the order of magnitude 04:33PM

0236

difference in concentrations are two different things. Log transformation will take the skewness out of a lognormal distribution. It will -- if it is truly a lognormal distribution, it will make it appear normal, but it doesn't -- it doesn't take out 04:33PM the concentration effect.
Q Okay. What would you have done to do that, sir?
A There are two transformations that I recommend in my book chapter that are in common use. One is 04:34PM transforming everything through percent of total concentration. The other is transforming -- you set some set chemical indicator at 1.0 and all other analytes are transformed as a ratio to that chemical, so -- 04:34PM
Q Are you critical of Dr. Olsen because with two PCs, you cannot calculate all the individual constituents of concern with an acceptable degree of goodness-of-fit as portrayed in the CD scatter plots, Figure A-6? 04:34PM
A The question again? I'm sorry.
(Whereupon, the court reporter read back the previous question.)
A Yes.
Q Okay. Do you -- can you point to a section in 04:35PM

0237

Dr. Olsen's report that suggests that he's interested in predicting individual constituent concentrations from the PCs?
MR. GEORGE: Object to form.
A No, but that's not the purpose of a goodness-of-fit evaluation. 04:35PM
Q Well, isn't it true that in a PC analysis, one can always back calculate the original variables or the original constituents from all -- from the PCs if you use all the PCs? 04:35PM
A Yes. He didn't use all the PCs.
Q But you could do that if you took Dr. Olsen's

results, use all the PCs and do the back calculations; correct?
A Yes. You could reproduce it with 26 principal components. 04:36PM
Q If you used all the five PCs which Dr. Olsen identified in his analysis, in his considered materials, would you get an acceptable goodness-of-fit? 04:36PM
MR. GEORGE: Object to form.
A I would have to look at that, but I know that all the analytes -- the fit will always improve as you add an extra principal component --
Q But you didn't -- 04:36PM

A So I'm sure --
Q I'm sorry. I interrupted you.
A So I'm sure as you go to a third, you'll get a better fit for some analytes. You might get one to snap in and all of a sudden it looks great, but I can tell you that at five principal components, the bacteria are still not well explained. 04:36PM
Q Did you do the evaluation to see if you could get goodness-of-fit using five PCs?
A Yes. 04:36PM
Q You did?
A Yes.
Q And what did you find?
A I can't tell you from memory but I -- like I said, I do recall that at least the bacteria were still poorly fit at five principal components. 04:36PM
Q Anything else?
A Yes. None that I can recall as I sit here, though.
MR. ELROD: David, you really are running out of tape. I can tell by the expression on his face. He's about to panic. 04:37PM
MR. PAGE: Thank you. We'll take a break here.
VIDEOGRAPHER: We are now off the Record. 04:37PM

The time is 4:37 p.m.
(Following a short recess at 4:37 p.m., proceedings continued on the Record at 4:50 p.m.)
VIDEOGRAPHER: We are now on the Record.
The time is 4:50 p.m. 04:51PM
Q Dr. Johnson, before the break we were talking about goodness-of-fit using five PCs. Do you recall that?
A Yes.
Q You said you did perform goodness-of-fit with Dr. Olsen's data for the five PCs? 04:51PM
A Yes.
Q Where is that in your report?
A I did not include that in my report.
Q Why not? 04:51PM
A Because I was focusing on the model that he presented and interpreted.
Q Well, wouldn't it have illustrated your point concerning goodness-of-fit and using only two PCs?
A It wasn't necessary to inform the point that the fit for E. coli and Enterococcus and fecal was bad with two and so, no. 04:51PM
Q If I was looking for your considered

materials, how would I identify that analysis in your considered materials? 04:51PM

A Those -- the graphs that come up with the additional numbers of principal components comes up on the screen, and I don't know that I printed those off, so I'm not sure they would be in the considered materials, but the matrices in order to reproduce 04:52PM them, I believe they are in a -- within a file there.

Q You also said that there's an issue of bacteria when you did that analysis?

A With the goodness-of-fit? 04:52PM

Q Yes.

A Yes.

Q And where is that stated in your report?

A Well, since we're on this page, starting with just the graphic that we've been talking about on 04:52PM Page A-23 --

Q Uh-huh.

A -- on these series of graphs, if -- what you're looking at here, each of these little squares on the graph represents one of the chemicals or 04:52PM bacteria species or bacteria variables within the SW3 PCA. The X axis is the measured concentration in the original units, so we back calculate it to the original units. The Y axis is the concentration as back calculated from two principal components. 04:53PM

So if a two principal component model accurately back calculates the original data, you would expect to see the sample points plot on one of these bar graphs about this 45 degree angle line that bisects the graph from bottom left to top right. 04:53PM

Q Okay, but I'm asking you about the five PC analysis where you determined that bacteria can be identified within the five PCs.

A You were asking about the five PC analysis with respect to Enterococcus, and I was saying with 04:53PM respect to the fit of the bacteria variables, you can see on this graph that you need more principal components in order to accurately back calculate it. Did I misunderstand your question?

Q Well, I was asking you -- I thought you were 04:54PM following up on the five PC analysis, and you said that that analysis of the five PCs, if I understood you correctly, indicated that bacteria was not adequately accounted for, and I was trying to see where that conclusion is found in your report. 04:54PM

A In a -- in specifically a five principal component model?

Q Yeah.

A No. That -- I don't think I specifically state that. I was talking in general about the poor 04:54PM fit of the bacteria variables, which is why I started talking about this graph.

Q Okay. Can you tell me in your considered materials where I might be able to find that analysis of bacteria? 04:54PM

A Again, the -- these scatter plots for higher number of principal components come up on the screen. I don't know if I printed them off or not.

They may not be in the considered materials.
Q So you didn't retain that work that you considered as part of your production in this case? 04:55PM
MR. GEORGE: Object to form.
A I retained the output of the matrices, which are provided.
Q For the five PCs? 04:55PM
A The full principal component matrix is provided. So you can take that matrix and take only the first five PCs and reproduce -- and reproduce the reduced dimensional principal component estimate of the matrix and plot these graphs with that data. 04:55PM
Q What was the reason for you doing the five PC analysis?
A Let's back up a step. The way this scatter plot utility works is after we run the PCA, it's up on the screen, cycles through a series of scatter 04:56PM

0243

plots, just like this, except the next one would come up and it would be a three-principal component series of scatter plots. When you hit return and the next one that would come up would be four. You hit return and the next one to come up would be 04:56PM five. So that's the -- that is what I mean when I say I looked at the goodness-of-fit of five principal components, but then it goes on beyond that, and I think what I mentioned earlier today is if you go through those series of scatter plots, you 04:56PM get up to eight, nine, ten principal components before any of the bacteria species start to approach this one-to-one fit line.
The reason I'm answering it this way is the way your question was worded implied that you 04:57PM weren't understanding how I was going about getting these scatter plots.
Q Well, I asked you if you did do a five PC goodness-of-fit analysis and you said you did.
A Yes. 04:57PM
Q And I was asking you why you did that.
A Because I always look at the scatter plots going up the higher number principal of components.
Q Okay, and when you did that, did you determine whether or not there were any other sources in the 04:57PM

0244

IRW that might be related to any of the PCs?
MR. GEORGE: Object to form.
A I did not try to tie individual -- I did not try to tie principal components into five PC space to two sources, no. 04:57PM
Q Well, when you did the other PC analysis, did you -- were you able to identify any sources maybe in PC 6, 7 or 8 that were not identified by Dr. Olsen?
A For the reasons I -- 04:58PM
MR. GEORGE: Object to form.
A Sorry.
MR. GEORGE: Go ahead.
A For the reasons I stated in my report, I forget how many principal components. I think it 04:58PM was copper, arsenic and zinc. I forget where those start to snap in, but when -- in order to fit the bacteria species, we were up around eight, nine, ten principal components given the -- as I expressed

this in my report, given the questions I had about the bacteria data, I didn't have any confidence that an eight-principal component model would actually be identifying a bacteria source because the data -- given the missing data within that, I think basically at that point, even if you get a scatter 04:58PM

plot that looks like it's giving you a good fit, you're probably fitting noise rather than source.

Q So is it fair to characterize your testimony, Dr. Johnson, that you were not able to identify any other sources by looking at these PCs beyond PC1 and 2? 04:59PM

MR. GEORGE: Object to form.

A With this dataset, that's a fair characterization. I was not able to.

Q Turn to Page A-18 of your report, please. 04:59PM

A Okay.

Q First full paragraph, are you referring to some transformations that you recommend Dr. Olsen to perform in his analysis? It's the upper part of that first paragraph. 04:59PM

A The sentence that starts -- oh, you're above 8.23?

Q Yes, sir.

A Oh, I'm sorry.

Q It is worth mentioning, the first full paragraph on that page. 04:59PM

A Okay. Yes. It is worth mentioning a transformation that Olsen did not do and, yes, that is -- we talked about that before this last break I believe. That was the issue of normalizing con -- 04:59PM

normalizing -- a normalization to take out the differential concentration effect.

Q Okay. Did Dr. Olsen not do Z-transformation?

A He did a correlation transformation of log transformation, and that is basically the same thing. 05:00PM

Q Well, wouldn't the correlation transformation take out the order of magnitude effect that you're concerned about?

A No. 05:00PM

Q It would not?

A It would not.

Q So what transformations do you recommend?

A I recommend a transformation -- this is in my book chapter -- a sample normalization, such as a percent transform, or this setting of indicator variable as one and the others as ratios of that. One of those two is what I would call sample normalization. The second transformation I recommend is what I would call homogeneity variance transform, which could be an autoscale, which he did do, or a range transform. 05:00PM

Q Don't other PC investigators use the transformation that Dr. Olsen used when they do their PC evaluation for sources? 05:01PM

A Which one?

Q I can show you some papers if you like.

MR. GEORGE: Which transformations?

A No, no. Which transformation? You said the

transformation. There were more than one. 05:01PM
Q Oh. The log transformation and the Z-transformations.
A The Z-transformation, I think, is quite common. The log transform is probably out there. I don't think it's -- I personally don't find it to be 05:01PM that useful. I rarely use it.
Q Isn't log transformation of environmental data typically done?
MR. GEORGE: Object to form.
A It is often done if you are doing a 05:01PM statistical hypothesis test that carries with it the assumption of a normally distributed data.
Q But isn't it typical that environmental data is normally distributed?
A I'm sorry? 05:01PM
Q Isn't it typical that environmental data is normally distributed?
MR. GEORGE: Object to form.
A No.
Q Excuse me. Lognormally distributed? 05:02PM

A Lognormal distribution is very common.
MR. GEORGE: Object to form.
Q So log transformation would be appropriate in those circumstances, would it not?
A Again, if you were doing a statistical 05:02PM hypothesis test which carries with it the assumption of a normal distribution. PCA is not one of those.
Q Let me hand you what's marked as Exhibit 9. Dr. Johnson, if you would, review that and tell me if you've ever seen that paper before. 05:03PM
A No, I do not know this paper.
Q Okay. Would you look with me, sir -- could you just read for the Record what we're looking at?
A This is a paper by Gnler, et al.
Q Could you give us the title, please? 05:03PM
A Evaluation of Graphical and Multivariate Statistical Methods For Classification of Water Chemistry Data.
Q And where has it been published?
A It is in a journal, Hydrogeology. 05:03PM
Q Are you familiar with that journal?
A I have heard of that journal.
Q Okay. Would you turn with me to Page 462, sir? The top left-hand corner, would you begin with the first sentence through the balance of that 05:04PM

paragraph and read that for the Record.
A The data were log transformed, except for pH, so that they more closely corresponded to normally distributed data.
Q Continue. 05:04PM
A Then all the eleven variables were standardized by calculating their standard scores, Z scores as follows, and then it gives the Z-transform formula.
Q So for the work that was done for this 05:04PM multivariate statistical method, the investigator did a log transformation and then a Z-transformation when he did his analysis?
MR. GEORGE: Object to form.
A That's what it says. 05:04PM

Q That's essentially what Dr. Olsen did; is that correct?
A Yes, it is but, again, I don't know -- again, this is an example of a paper you asked me to look at for several seconds and read two sentences. I would like to understand these sentences in context. 05:05PM
Q Weren't these -- this paper identified in Dr. Olsen's expert report, sir?
A I don't recall.
Q Let me hand you what's marked as Exhibit No. 10. Can you identify that document for me, sir? 05:05PM

A The authors are Zhou, Guo and Hao. I hope I'm doing okay on the pronunciations, Chinese authors, Spatial Distribution of Heavy Metals in Hong Kong's Marine Sediments and Their Human Impacts: A GIS-Based Kilometric Approach. 05:06PM
Q Okay, and would you read the title, please?
MR. GEORGE: He did.
MR. PAGE: Oh, he just did that.
A I just did. 05:06PM
Q I apologize. It's late in the afternoon. What does it mean to do a GIS-based kilometric approach?
A I would have to read the paper to find out. I assume they're using both GIS and kilometric methods, but how they're integrating the two and using them, I couldn't tell you from the title. 05:06PM
Q Okay. Could you take a quick look through the paper and see if you can determine that?
MR. GEORGE: Dr. Johnson, take as much time as you need as opposed to a quick look. 05:06PM
Q Well, was this paper not part of Dr. Olsen's expert report?
MR. GEORGE: Part of his expert report?
Q As cited in his expert report? 05:07PM

A I don't recall.
Q Did you read the papers that were cited in Dr. Olsen's expert report?
A No, I did not.
Q Did you read the papers that were specifically cited -- 05:07PM
A There were some of them that I've read. I've not read the two that -- if you're representing that these two were cited in his report, I have not read these two. 05:07PM
Q Okay. Let me ask you this question: Did you read the papers that Dr. Olsen referenced as supporting the PCA methodology that he employed?
A Again, I can tell you that I've not read these two papers. I would have to look back to see if any of those papers I have read. 05:07PM
Q Okay. Would you take a look and see if you can determine what they're referring to there in their kilometric approach? Maybe if I could direct your attention to Page 1378. 05:08PM
A Okay.
MR. GEORGE: You can direct him where you like, David, but if he wants to read the whole article, he has that right.
Q And Section 3.4, the first sentence. 05:08PM

A I'm sorry, did you say 378?
Q Yes, sir.
A The first sentence?
Q Yes.
A GIS-based PCA is an effective method to determine human impacts on a spatial scale. 05:08PM
Q Okay. Does that help you understand what they were doing in this case?
MR. GEORGE: Object to form.
A Not much more than the title did. They're using GIS and PCA. 05:08PM
Q Okay.
A Did you want me to continue on that paragraph?
Q Let me ask this question: On Page 1375 where it says data pretreatment, do you see that area, sir? 05:09PM
A Uh-huh.
Q About halfway down that paragraph it begins however.
A Okay. 05:09PM
Q Could you read that down through the Einax 1997 citation, please?
A However, after log transformation, Shine, et al, 1995, Kowalkowski, et al, 2006, all transformed variables were observed to almost fit a normal 05:09PM

0253

distribution with significantly reduced skewness and kurtosis values.
Q Please continue.
A CA and PCS were performed on the standardized datasets, whose means and variance were set to zero and one respectively, to minimize the effects of differences in measurement units or variance and to render the data dimensionless. 05:09PM
Q Does this not indicate that these investigators employed similar transformations as Dr. Olsen before they did their PCA analysis? 05:10PM
MR. GEORGE: Object to form.
A Yes, they did, but without looking at the data, I don't know the degree to which they also should have done a concentration normalization. 05:10PM
Q They don't mention doing that other concentration normalization?
A Not that I see here, no.
Q Would you take a look at Page 1382, please?
Second column about a third of the way down where it says in addition, could you read that sentence, please? 05:10PM
A I'm having trouble finding it. Second column?
Q Yeah.
A I'm on the wrong page.

0254

Q Page 1382. I might have misspoken. Where it begins in addition. It's about eight lines down.
A In addition, GIS-based PCA further identified three potential sources, two of which were due to human impacts, industrial pollution, agricultural runoff and vehicle emissions were in the first class of anthropogenic pollution. 05:11PM
Q Does it appear that --
A Did you want me to finish the sentence or is that fine? 05:11PM
Q You can finish. I'm sorry, sir. I cut you

off. Go ahead and finish.
A I think the last word I read was pollution, comma, mainly affecting Victoria Harbour, inner Tolo Harbour, Eastern Buffer Zone and inner Deep Bay, 05:11PM
whereas electroplating and textile factories and ship antifouling paints were the second time -- were the second type of human waste impact, mainly influencing the area of Tsuen Wan Bay and Rambler Channel. You may have been right stopping me 05:12PM
halfway through the sentence.
Q You did a great job of pronunciation. Does it appear that the investigators in that case, using the transformations discussed, were able to identify sources through PCA analysis? 05:12PM

MR. GEORGE: Object to form.
A Yes. Again --
Q You answered my question. Thank you, sir.
A Well, I'd like to -- every time you go into a dataset, the transformations that you do or do not 05:12PM
do is project specific. If they -- maybe they had a reason for leaving out sample normalization. Perhaps they didn't have a reason and they somehow got it through the peer review, but without looking at the actual data to see -- I don't even know what 05:13PM
analytes they're talking about here. What are we -- heavy metals. Without looking at the data and detection limits and the influence that that might or might not have had using those transformations, it's difficult for me to evaluate whether I agree 05:13PM
this was a valid thing to do or not.
Q Okay. Let me hand you what's been marked as Exhibit 11. Can you identify that paper for the Record, sir?
A The title is Chemometric Application in 05:14PM
Classification and Assessment of Monitoring Locations of An Urban River System by four guys who I'd rather not try to pronounce their name unless you request it.
Q Can you read the abstract -- or have you ever 05:14PM

read this paper before?
A I've not seen this paper.
Q Do you know whether or not it's in Dr. Olsen's support for his PCA analysis?
A I do not. 05:14PM

MR. GEORGE: Are you representing that it is, David?
MR. PAGE: Yes, sir, I am.
MR. GEORGE: It's referenced in the PCA section of his report? 05:14PM
MR. PAGE: It's referenced -- I think there's a list of -- he has an appendix where he has a list of articles that employed similar PCA analysis. I think it's an appendix to his report.
A I'm sorry. Was there a question pending? 05:14PM
Q Not yet.
A Oh, okay.
Q But I'm getting close to one. Would you turn with me, sir, to Page 392? Can you review the second or under Section 2.3, data treatment and 05:15PM
chemometric methods, and tell us the data transformations that were employed by these

investigators in this paper.
A Section 2.3?
Q Yes, sir. I'm not going to have you read it 05:15PM
out loud. I just want you to review it and report
to us what the data transformation methods were.
MR. GEORGE: Under the chemometrics method;
is that what you're referring to?
Q Data treatment and chemometric methods. 05:15PM
A It says he used a Box-Cox transformation to
transform the data in normal form. So let me read
on and see if there are others.
Q Does the Box-Cox transformation include lump
transformation? 05:16PM
A I'm not familiar with the Box-Cox
transformation.
Q Do you see the equation about middle of the
column, W equals GIN -- LN, excuse me.
A Yes.
Q Y plus -- I don't know what that symbol is?
A Lambda.
Q Lambda.
A Which I know what it's called. I don't know
what it is. What is Lambda? 05:16PM
Q Is this a log -- is this a formula for log
transformation?
A There's an LN in front of the parenthesis.
I'm not sure what Y is, and I'm not sure what Lambda
represents in terms of data. 05:16PM

Q Okay. So you don't recognize that as a
formula for log transformation?
A No. I just said that the LN means lognormal
-- I mean, it means natural log. So whatever is
inside the parenthesis, Y plus Lambda 2, is with -- 05:16PM
under that equation is being transformed by a
natural log transformation. What I'm saying is I
haven't read this paper to know what Y plus Lambda 2
is.
Q Okay. Well, doesn't it say right there what 05:17PM
those integers represent?
A It says below it, Lambda 1 and Lambda 2 are
transformation -- the transformation parameter,
which doesn't yet enlighten me, and G is the
geometric mean, so -- 05:17PM
Q Do you see any other transformations listed in
this section of the report?
A The Z-transform is the next formula down below
that paragraph.
Q And Z-transformation is a transformation 05:17PM
employed by Dr. Olsen in this case?
A Yes.
Q Turn to Page 397, please. The first full
column, can you tell me whether or not the
investigators in this case were able to identify a 05:18PM

source with their PC Factor 1 in this case?
A The first full column?
Q Yeah.
A They're claiming that they do.
Q Okay. 05:18PM
A They are equating -- it appears that they are
equating a Varimax factor with a source and making a

very similar argument, and I would -- if that is what they were doing and, again, I would prefer not to pass judgment on a paper based on a one-minute read-through, but if that's what they were doing here, I would take them to task the same way I did Dr. Olsen.
Q Do you know when this paper was published? 05:19PM
A 2006.
Q And do you know what journal it was published in?
A Analytical -- Analytica Chimica Acta.
Q Are you familiar with that journal?
A I've heard of that, yes, sir. Could I take a minute to read this additionally? 05:19PM
Q Sure.
A In fact, I need to take a quick break but -- if -- unless you have a question pending.
Q No, I don't. 05:19PM

A Okay. I'd just like to take a quick break.
Q If you need to take a quick break, go ahead.
A Okay, and when I come back, I'd like to just take a quick look at this before we go back on the Record. 05:19PM
VIDEOGRAPHER: We are now off the Record. The time is 5:19 p.m.
(Following a short recess at 5:19 p.m., proceedings continued on the Record at 5:45 p.m.)
VIDEOGRAPHER: We are now on the Record. 05:25PM
The time is 5:45 p.m.
MR. PAGE: Was there a question pending?
A I was under the impression that we were going further.
COURT REPORTER: I don't believe so. Let me check.
(Whereupon, the court reporter read back the previous questions and answers at Page 260, Lines 19-25.)
Q Okay. I think I was finished with that paper. 05:26PM
We're back on the Record? Okay. Thank you. Dr. Johnson, do you complain that Dr. Olsen performed his PCA analysis on only a subset of the total samples that were collected as part of the State's investigation? 05:26PM

A I point that out as -- I wouldn't use the word complain. I point that out as a symptom of how much missing data there was in the full suite of samples that were collected. The numbers are in the table within my report, but the number of samples that, 05:27PM based on the group's chosen that were eligible to be within SW3, was on the order of 2,300 something. The number of samples after the missing data criteria that was used ended up at -- I think it was 573. So it's an informative thing to look at when 05:27PM you are evaluating the degree to which all samples were analyzed for these chemical parameters.
Q Well, are you suggesting that all 2,000 samples that are in the Access database for the State were intended to have an analysis of all of 05:27PM the parameters that were evaluated in a PCA?
MR. GEORGE: Object to form.
A I don't know. I can't second guess what the

intent was or why some of them were analyzed for a full suite of analytes and others were not.
Q Do you understand that there was more investigations going on for the State's case in addition to Dr. Olsen's PCA analysis?
A I believe so, yes.
Q Would you concede that the database for the 05:28PM

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State of Oklahoma could include samples that were never intended to be part of the PCA analysis?
MR. GEORGE: Object to form, asked and answered.
A I would concede that's a possibility, yes. 05:28PM
Q You don't know one way or the other; correct?
A No.
Q Dr. Olsen's sample size was 573 samples; is that correct?
A Uh-huh. 05:28PM
Q Would you consider that a rather robust sample size for a PCA analysis?
A Well, the conversation is being framed in terms of the criticism related around missing data, not those 573. 267 was the number that had no 05:29PM missing data.
Q Okay.
A So I've been asked this question a number of times, how many is enough samples for one of these analyses, and it depends on the sampling plan. 05:29PM
Q Did you evaluate Dr. Olsen's methodology for sampling for his PCA analysis?
MR. GEORGE: Object to form.
A In terms of -- in terms of stream samples, no. In terms of assumed or purported source samples, 05:29PM

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yes. I pointed out in my report that there were -- I believe it was on the order of 80 to 90 edge of field samples within the database. 60 some odd of them made it into SW3, and in contrast, there were two cattle edge of field samples and originally four 05:30PM wastewater treatment plant based on the scores plot you showed me earlier. That's now considered to be three.
Q Do you understand that poultry waste is applied to fields where cattle graze? 05:30PM
A Yes, I've heard that.
Q Okay. Would it then be reasonable to believe that runoff from cattle waste would also be part of any edge of field sample --
MR. GEORGE: Object to form. 05:30PM
Q -- that was collected?
MR. GEORGE: I'm sorry. Object to form.
A Could you reread the question, please?
(Whereupon, the court reporter read back the previous question.) 05:30PM
A If there was both cattle waste and poultry litter on the same field, I would not presume to dismiss either as a potential source.
Q Okay, and the cattle edge of field samples that you're concerned over, there was just two, that 05:31PM

0264

was a field that was identified as never having poultry waste applied to it; correct?
A That's correct.

Q But did the other edge of field samples that were collected, did they exclude cattle waste from those fields? 05:31PM
A I believe that Dr. Olsen testified that most of those he couldn't tell whether they were. He said there probably was some cattle impacting those fields, which made me raise the question then why is the presumption that all the edge of fields are poultry impacted. 05:31PM
Q Sir, did you understand that Dr. Olsen did his analysis of sampling or the sampling plan based on stratified random design? 05:31PM
MR. GEORGE: Object to form.
A I don't know that I've seen -- no, I've not seen where he -- where he describes it as a stratified random design.
Q Did you review Section 2 of his report where he talked about the sampling plans? 05:32PM
A I believe I did. I don't recall seeing that statement of a stratified random design, and I did not evaluate the sampling plan to determine if I agree if it indeed was a stratified sampling, a 05:32PM

0265

stratified random sampling design.
Q Would that influence your criticisms on sampling?
MR. GEORGE: Object to form.
Q For use of missing samples that were not used in the PCA analysis that were part of the database? 05:32PM
A With regard to criticism I just spoke of, no, because whether it was stratified, random or not, the fact that we know that those fields were potentially impacted by both poultry and cattle and then to carry forth the assumption that all the edge of field samples near those fields represent poultry but not cattle, to me that objection is independent of whether or not it was a random stratified sampling design. 05:32PM
Q Okay. Let me ask you this question: Did you do any evaluation as to whether or not the missing data in the samples that ran the PCA had an influence on the PCA results? 05:33PM
A Well, yes. I looked -- I looked at where the missing samples plotted on the PCA graph. 05:33PM
Q Okay. Did you find that there was -- the fact that not all of the 573 samples had all 26 parameters, that some of them had as few as 20 parameters, had an influence on the PCA plots? 05:33PM

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A Well, the comparison that you're talking about then would be the comparison between PCA run SW3 and PCA run SW15. SW15 was a run where only -- where all the missing data contained in samples were removed from the analysis. It was only 267 samples. 05:34PM
Q And Dr. Olsen performed that sensitivity analysis, did he not?
MR. GEORGE: Object to form.
A Yes, he did.
Q Okay, and did you also review that sensitivity analysis? 05:34PM
A I reviewed SW15, yes.
Q Okay, and did you find that the missing data had a significant effect on the PCA?

A Yes, I did. 05:34PM
Q And that's based on your review of what?
A If you look at the missing data -- the general shape of the data cloud for SW15 and SW3 looks very similar and that is because of the extreme samples. Which are those edge of field samples at the top 05:35PM right, near the top right side of the scores plot, those four samples don't have missing data. So whether you look at SW15 or SW3, those samples are still going to be defined in that corner of the plot. The samples at the end of -- we talked this 05:35PM

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morning about Trend 1 versus Trend 2, the bottom trend versus the top left trend.
Q Uh-huh.
A There was some missing data out near those trends, but there were also samples that were fully 05:35PM represented in SW15, but the point is, so if you just looked at one scores plot compared to another, the general shape of them is very similar. Your question was, did it impact the PCA. I maintain that it did. The samples with missing data were 05:35PM primarily stream samples, and I'd say maybe half of them plotted with -- between PC1 equals 1.2 and PC1 equals 1.4, where his cutoff was 1.3. So over half of the SW3 samples were missing, and of that group, over half of them were within a .1 PC1 score of his 05:36PM threshold. So you've got a majority of your samples that are falling very close on either line of this supposed poultry waste signature threshold that have missing data. So I think it's very pertinent. That means a number of those red dots that show up on his 05:36PM red dot-green dot map are being defined by samples with the missing data that end up falling very near the 1.3 line.
Q But you'll agree with me, will you not, that the scree plots themselves, the design of the scree 05:37PM

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plots for the missing versus no missing values look very similar?
A I'd have to go back and look at the scree plots.
Q Let me help you out there. I'll hand you 05:37PM exhibit -- I'll hand you what's been marked as Exhibit 12, and I'll represent to you, sir, that this is a Table 11 -- 6.11-7A from Dr. Olsen's report, and we've attached to it the sensitivity runs that we've been discussing both with and 05:38PM without missing data and corrected for the unlogged transformation. So I think the scree plots we were focusing on may be the last four pages of this exhibit.
A Could I get a clarification, please? 05:38PM
Q Excuse me. The PC -- they're PC plots. I think I said scree.
A You did say scree plots. That was my first question. This is not a scree plot.
Q Yeah. This is -- I misspoke. 05:38PM
A My second question is, you just represented that this graph has -- now has the log transform undone correctly, but these look exactly like the ones in his original report.
Q Well, there's two others that follow. 05:38PM

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A Oh, okay.
Q There's a total of four PC plots.
MR. GEORGE: Just so I'm clear, David, the last two pages of Exhibit 12, the cover of which is Dr. Olsen's expert report that was originally 05:39PM
submitted in this matter, are work product that he has produced in connection with the report that was delivered in February; is that right?
MR. PAGE: The last two pages, yes.
MR. GEORGE: All right. Do you have any 05:39PM
objection, just for clarity, to severing these last two pages so that -- they're not really part of the report to which they attached; right?
MR. PAGE: Well, this is a collection of information that came from Dr. Olsen's report. The 05:39PM
last two pages would be errata to that report making the changes to the third and fourth -- excuse me -- yeah, the third and fourth to the last pages.
MR. GEORGE: And this is a product of my poor memory, David. Were the last two pages 05:39PM
actually part of the supplemental or errata report or declaration?
MR. PAGE: Yes.
MR. GEORGE: They're actually attached to that declaration? 05:40PM

0270

MR. PAGE: Yes.
MR. GEORGE: Okay. Well, I'm going to have the same objection I had earlier to the last two pages of Exhibit 12, which is to the extent this is the product of analysis that is the subject of a 05:40PM
report that is untimely for which the State has neither sought nor obtained leave to submit in this matter, we object insofar as you're trying to get those opinions into the Record in this case.
MR. PAGE: Okay. Robert, let me make a 05:40PM
correction. The last page of this report, SW15, was not part of the errata.
MR. GEORGE: Okay. So then I guess I need to know where SW -- where the last page came from.
MR. PAGE: It was part of the analysis that 05:40PM
was done by Dr. Olsen.
MS. COLLINS: You're saying these are from the February 10th?
MR. PAGE: Except for the last page that was not attached. 05:40PM
MR. GRAVES: When was the analysis on the last page done?
MR. PAGE: In February, January or February.
MR. GRAVES: But it's not been submitted as 05:40PM

0271

part of any errata or other declaration?
MR. PAGE: No.
MR. GEORGE: Same objection.
Q Let's look at the fourth and third to the last pages. 05:41PM
A Fourth and third to the last?
Q Yeah. I think they're numbered 1 and 2 at the bottom right-hand corner.
MR. GEORGE: By the way, where are Pages 3 and 4? 05:41PM

A Okay.
MR. GEORGE: It goes 1, 2, 5, 6? Don't know?
MR. PAGE: No.
A If that's the way, I have no 3 or 4. So I do have 1 and 2. 05:41PM
Q Okay. Could you compare those two PC plots and tell me whether or not the patterns are similar?
A Yes. As I just testified to, the general shape of the data cloud for SW3 and SW15 is similar because that general shape of the data cloud is being driven by these four edge of field spread samples and the extreme samples here. So the general shape, as the eye looks at it, is similar with this L-shaped data cloud, and the other part of 05:41PM 05:42PM

0272

my previous response is also very clear on here. If you start to -- if you compare the figure from SW3 on the page that has a 1 at the bottom to the figure in SW15, you can see that there -- that the samples that are missing from the second page are preferentially right in this area. Now -- 05:42PM
Q Of the area where it's very close to --
A Well, it's not close to 1.3 here because this one does not do that final little translation that Dr. Olsen did to get rid of negative values. So this actually is not a scores plot as shown in the report because he did the translation so that there would be no scores, either PC1 or PC2, that would be less than zero. So the 1.3 line on this graph is irrelevant because the translation has not been done or the 1.3 threshold is irrelevant. 05:42PM 05:43PM
Q When you compare the runs for where they have missing and non-missing data, the general patterns are the same, are they not, for the PC plots?
A The general shape of the data cloud looks similar. The general pattern of the samples right in this area of highest density, which is around -- once you translated them, it's around this critical region of the 1.3 threshold is different. A lot of the missing data falls in that area. 05:43PM 05:43PM

0273

Q If we had the data for the missing values, would the PC1 scores be higher?
MR. GEORGE: Object to form.
A All others things being equal, I mean --
Q Yeah, yeah. 05:44PM
A I don't think adding those missing data would all of a sudden make this principal components analysis have a good fit for two principal components, so at least on that respect, no.
Q But it raised the PC scores? 05:44PM
MR. GEORGE: Object to form.
A Would it raise them?
Q Yes.
A No, it would not raise the scores. It would change the scores because you'd be calculating principal components with real data instead of assumed data, but I doubt they would all go higher. 05:44PM
MS. COLLINS: I'm going to make a late objection to Exhibit 11 and the characterization of it because Pages 5 and 6 have diagrams that are not included in the February 10th, 2009 Olsen 05:44PM

declaration.
MR. GEORGE: And I'm going to move to strike them because they haven't even asked a question about it. 05:44PM

MR. PAGE: Well, I'll go ahead and ask a question about it then, Robert.
Q Would you review the last two pages, and I'll represent to you that this will be PC plots.
MR. GRAVES: David, before you ask the 05:45PM
questions, can I also ask whether those last two pages are -- I think you represented at least one of them has not been made a part of any errata or declaration. Are you claiming that it is errata material or is it just additional analysis that Dr. 05:45PM
Olsen has done?
MR. PAGE: I'm using this to cross examine the witness.
MR. GRAVE: I'm asking what they are, though. 05:45PM
MR. PAGE: Well, they haven't been attached to any errata.
MR. GRAVES: But what are you claiming that they are?
MR. PAGE: Well, like I represented, the 05:45PM
last two pages are the PCA analysis with the correction on the transformation. The next to the last page is in the errata; the last page is not.
MR. GRAVES: The last page is not in the errata? 05:46PM

MR. PAGE: Which is the sensitivity analysis.
MS. COLLINS: And, again, I object to that characterization because neither Page 5 or 6 are in the -- 05:46PM
MR. GRAVES: And I'll move to strike it as well because there's an order in the case about supplemental expert opinions.
Q Dr. Johnson, do you remember the question?
A No. Sorry. 05:46PM
MR. GEORGE: Do you see them I think was the question.
A Yes, I've seen them if that was the question.
MR. PAGE: That's probably about as far as I got. 05:46PM
Q Would you tell me whether or not the patterns for those two pages are similar?
MR. GEORGE: Object to form.
A Again, the shapes of the two data clouds in terms of the general outline is the same. The 05:46PM
density of dots on the second figure is obviously much lower because the missing data have been removed.
With regard to my other discussion with regard to the scores plots that were produced in the 05:46PM

original report, it's difficult for me to comment with regard to where those missing data lie with respect to a poultry litter or a poultry litter signature because I've -- it's not been represented to me where the new threshold now lies. 05:47PM
Q Wouldn't the fact that the patterns of the

plots remained essentially the same support the conclusion that the minor amount of missing data for some of the samples used in the PCA did not have a substantial impact on the PCA analysis performed by Dr. Olsen? 05:47PM

MR. McDANIEL: Object to the form.

MR. GEORGE: Object to form.

A Over half of the samples to me is not a minor amount of missing data, and given that, no. 05:47PM

Q But of those samples that did have missing data, there was no more than six analytes of the 26 that were missing; correct?

A Yes, but as I point out in my report, those analytes that are missing are -- they're not evenly spread across the dataset. They are preferentially within the bacteria variables, which are one of the variables that is cited as being part of the poultry signature. 05:48PM

Q Would you turn to Page A-14 of your report, please? 05:48PM

MR. GEORGE: Are we done with Exhibit 12, David?

MR. PAGE: For now, yeah.

MR. GEORGE: David, does the State intend to seek leave to submit the February report or errata of Dr. Olsen, leave from the court? 05:48PM

MR. PAGE: I don't know.

MR. GEORGE: Well, just so you know, until such time as the State seeks and secures leave, it is the defendants' intention to ignore that report. 05:48PM

MR. PAGE: Are you suggesting that we can't cross examine our witness with exhibits that are not contained in Dr. Olsen's report?

MR. GEORGE: Am I cross examining which witness? 05:49PM

MR. PAGE: This witness.

MR. GEORGE: I've made my Record with respect to the cross examination of this witness. My question -- I'm simply putting the State on notice that to the extent the State believes that the additional work done by Dr. Olsen that is reflected in his February errata is part of his expert opinions on which he will testify at trial, that the defendants are going to ignore that material until such time as the court grants leave. 05:49PM

MR. PAGE: Well, rather than talk about this on this Record with this witness and my examination of this witness, I think it would be more appropriate to send a letter to someone. 05:49PM

MR. GEORGE: I've made a letter here, and Lisa is just as good as a letter.

Q Can we turn to the bottom -- I think it's --

A You had said A-14 I believe.

Q Yes, sir. 05:49PM

A Okay.

Q Would you read the last paragraph, and I have a couple of questions to ask you about that, sir.

A Okay. Well --

Q Would you read it out loud? 05:50PM

A Coming into that paragraph, I'm describing the number of samples that were missing within SW3.

Q Okay.
A So now I'll read the paragraph.
Q Out loud, please. 05:50PM
A This entire practice was puzzling because, one, it is not possible to calculate principal components using a matrix with missing data, a/k/a holes in the matrix.
Q Okay. Could you explain that statement, 05:50PM please?
A When you plug in missing data, you cannot get all of the matrices that you are supposed to get out fully populated for -- especially for the samples where there was missing data. If you have missing 05:51PM data in a matrix -- for example, in SysStat, you run a PCA and then you go to the results side of the analysis and look at the scores, there will be no scores reported for the samples that had missing data. So that's what I mean by that statement. 05:51PM
Q Okay. Are you saying that SysStat will not do an analysis on those samples where there's missing data?
A There's an option where it will calculate a correlation matrix by allowing correlations -- if 05:51PM you have two pair of analytes where there might be a missing data point in another analyte. The correlation between those two analytes will be used to help to calculate the correlation matrix rather than deleting the entire sample, but my statement 05:51PM is, you don't get -- at the end of that whole process, you don't get scores for those samples.
Q Okay, and did Dr. Olsen then take samples and then calculate scores?
A Yes, he did. 05:52PM
Q And how did he do that?
A I'm not entirely sure. He indicated that he did them after SysStat. I could not find a way to reproduce that calculation. The way I've described here ended up reproducing the scores very closely. 05:52PM
Q Do you recall whether or not Dr. Olsen simply added zero for those components where there's a missing value?
A There's indication that that is exactly what he did. 05:52PM
Q Okay.
A Within -- well, and recall that the transformations that have been done here, we've talked about them quite a bit, were the log transform and then the Z-transform. The Z-transform 05:52PM is also called mean centering. You fix the mean at zero and the standard deviation at one. So if you're working in that transformation space, plugging in the zero is equivalent to plugging in the mean. 05:53PM
Q Can we go -- what if he -- what if he transformed it before he did the calculations -- untransformed it before he did the calculations?
A Which calculations?
Q The PC scores, calculating the PC scores for 05:53PM those samples with missing data.
A You're asking me to comment on what would

happen if he did a calculation that hasn't been well described in his report. Are you representing that he undid the correlation matrix with a Z-transform and then got out of that transformation and then plugged in zero instead? 05:53PM

Q No, sir, I'm not representing that.

A Okay. Then I'm -- then, no, I don't think he did that. 05:54PM

Q Okay. Let me ask you another question. Do you know how Dr. Olsen calculated his PC scores for samples with missing data?

A No, I don't. No. The exact calculation, no. I'm quite sure that it was -- that it is mathematically the same as plugging in the mean. 05:54PM

Q Okay. Which would be zero?

A If you're in the -- if you're in the correlation matrix or Z-transform space, that is zero. 05:54PM

Q Okay. Let's continue on at the bottom of A-14. No. 2, would you read that?

A While SysStat allows samples with missing data to be input into a PCA, the software will, by default, delete such samples from analysis and will 05:55PM

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not return principal component scores for them.

Q Isn't it true that there's a methodology in SysStat called pairwise deletion where you can get scores for -- you can get the PCA analysis for samples with missing data? 05:55PM

MR. GEORGE: Object to form.

A You can get Eigenvalues; you can get loadings; you can get the PC coefficients. You will not get the scores.

Q Would you read the last sentence, please? 05:55PM

A But the PCA results produced by Olsen includes scores for all samples, including those with missing data.

Q Could you read the first sentence on the top of Page A-15, please? 05:56PM

A Olsen attempted to avoid this limitation with a workaround. He substituted the average, parenthesis, mean, concentration for missing data prior to running the PCA.

Q What is your basis for your assumption that Dr. Olsen substituted the average or mean for concentration for missing data prior to running the PCA? 05:56PM

A Because when I did that, I reproduced his scores. 05:56PM

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Q Is it not true that he could then -- he could run the PCA without substituting the mean data prior to running the PCA?

A Perhaps, but it's not clear to me what calculations he did to accomplish that. 05:56PM

Q I see I'm really down to the end of the tape. Let's take a break.

VIDEOGRAPHER: We are now off the Record. The time is 5:56 p.m.

(Whereupon, the deposition was recessed at 5:56 p.m.) 05:57PM

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SIGNATURE PAGE

I, Glenn Johnson, PhD, do hereby certify that the foregoing deposition was presented to me by Lisa A. Steinmeyer as a true and correct transcript of the proceedings in the above styled and numbered cause, and I now sign the same as true and correct.

WITNESS my hand this _____ day of _____, 2009.

_____
GLENN JOHNSON, PhD

SUBSCRIBED AND SWORN TO before me this _____ day of _____, 2009.

_____
Notary Public

My Commission Expires:
_____

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C E R T I F I C A T E

STATE OF OKLAHOMA)
) ss.
COUNTY OF TULSA)

I, Lisa A. Steinmeyer, Certified Shorthand Reporter within and for Tulsa County, State of Oklahoma, do hereby certify that the above named witness was by me first duly sworn to testify the truth, the whole truth and nothing but the truth in the case aforesaid, and that I reported in stenograph his deposition; that my stenograph notes were thereafter transcribed and reduced to typewritten form under my supervision, as the same appears herein.

I further certify that the foregoing 284 pages contain a full, true and correct transcript of the deposition taken at such time and place.

I further certify that I am not attorney for or relative to either of said parties, or

otherwise interested in the event of said action.
WITNESS MY HAND AND SEAL this 7th day of March, 2009.

_____
LISA A. STEINMEYER, CRR
CSR No. 386

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GLENN JOHNSON, PhD
Volume I

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